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SCIENTIFICK INVESTIGATION.

The following article goes to define and illustrate what is meant by the term Science, and is taken from a work recently published at the south, re-printed from an eminent Scotch writer, and is presented in the Magazine for the younger portion of its readers. All, however, may be led to an interesting train of thought, from its perusal.

"Science, in its most general acceptation, denotes *knowledge* of every description; in a more restricted sense, it denotes that species of knowledge which is acquired chiefly by the exercise of the human faculties; and in a still more restricted sense, it denotes that systematick species of knowledge which consists of rule and order,—such as geometry, arithmetick, algebra, natural philosophy, geography, astronomy, chemistry, mineralogy and botany.—In the observations which follow, the term may be taken in any one of these senses; but particularly in the last, which is the most common and appropriate meaning. By means of scientifick investigation, the powers of the human mind have been wonderfully strengthened and expanded, and our knowledge of the operations of the Creator extensively enlarged. Science has enabled us to transport ourselves from one continent to another, to steer our course through the pathless ocean, and to survey all the variety of scenery which the terraqueous globe displays; it has taught us to mount upwards to the region of the clouds, and to penetrate into the bowels of the earth, to explore the changes which the earth has undergone since the period of its creation. It has laid open to our view the nature and constitution of the atmosphere, the principles of which it is composed, and its agency in supporting fire and flame, and vegetable and animal life. On the principles which science has established, we have been enabled to ascertain the distances of many of the heavenly bodies, to compute their magnitudes, and to determine the periods of their revolutions; and by means of the instruments it has invented, we have been enabled to take a nearer survey of distant worlds—to contemplate new wonders of creating power in regions of the sky which lie far beyond the utmost stretch of the unassisted eye,—and to explore those invisible regions, where myriads of living beings are concentrated within the compass of a visible point.—In consequence of such discoveries, we have been enabled to acquire more clear and ample conceptions of the amazing energies of omnipotence; of the inscrutable depths of infinite wisdom; of the overruling providence of the Almighty; of the benevolent care he exercises over all his creatures; and of the unlimited extent of those dominions over which he eternally presides.

The *faculties* by which man has been enabled to make the discoveries to which I have alluded, were implanted in his constitution by the hand of his Creator; and the *objects* on which these faculties are exercised, are the works of the Creator, which, the more minutely they are investigated, the more strikingly do they display the glory of his character and perfections. Consequently, it must have been the intention of the Creator, that man should employ the powers he has given him in scientifick researches; otherwise, he would neither have endowed him with such noble faculties, nor have opened to his view so large a portion of his empire. Scientifick investigations, therefore, are to be considered as nothing less than enquiries into the plans and operations of the Eternal, in order to unfold the attributes of his nature, his providential procedure in the government of his creatures, and the laws by which he directs the movements of universal nature. It is true, indeed, that every one who calls himself a philosopher may not keep this end in view in the prosecution of scientifick acquirements. He may perhaps be actuated merely by a principle of curiosity, by a love of worldly gain, or by a desire to acquire reputation among the learned by the discoveries he may bring to light, just in the same way as

some theologians are actuated in prosecuting the study of the christian system. But the discoveries which have been made by such persons, are, notwithstanding, real developements of the plans of the Deity, and open, to a devout mind, a more expansive view of the power, wisdom, and benevolence of Him who is "wonderful in council, and excellent in working." It is our own fault if we do not derive useful instruction from the investigations and discoveries of philosophy; it is owing to our want of intelligence to discriminate between the experiments of men, and the operations of God; and to the want of that reverence, humility, and devotion, which ought to accompany us in all our studies and contemplations of nature. Science, therefore, from whatever motives it may be prosecuted, is, in effect, and in reality, *an enquiry after God:* it is the study of angels and other superiour intelligences; and we cannot suppose there is a holy being throughout the universe that is not employed, in one mode or another, in scientifick research and investigation; unless we can suppose that there are moral intelligences who are insensible to the displays of the Divine glory, and altogether indifferent, whether or not they make progress in the knowledge of their Creator."

COMMUNICATION.] [FOR THE JOURNAL.

LOCATION OF RAIL-ROADS.

An important consideration in the location of Rail-Roads is, that they should be connected with the principal business places on their routes, if it can be done without injuriously affecting it, by greatly increasing its length or the inequalities of its level, and also that at its termination, it should be so connected with the business parts of the city, as to take and deliver the articles transported thereon as near as possible to the doors of the merchants.

I propose in this article to consider more immediately the practicability, and advantage of extending the proposed Rail-Roads throughout the city, by bringing the northern and western Rail-Roads, to Lechmere Point and there uniting them; then crossing Charles river, near the canal bridge, to the westerly end of Leveret street, and extending them across the vacant land and wharves north of Leveret to one of the streets on the Mill-pond land, and thence to the Mill-creek, and over that to the vacant land north of Faneuil hall market, from which branches may be extended to Long, Central, India and other wharves on the south, and through Commercial street to the stores and wharves at the north part of the city. They also might connect with the Providence rail-way, whenever constructed, which would be brought into the south part of the city, thereby making an uninterrupted communication through the whole city—which might be done in such a manner as not materially to obstruct the streets. It will at once be perceived that if the cars can be brought to the stores and wharves, a great saving is made in the expense of trucking and storing goods to be transported. The business of the rail-way is connected with that of the city, and the cars will at all times be in a situation to receive goods, with less trouble to the owners, than is necessary to transport them from one part of the city to another.

Large amounts of goods would be transported on the rail-way to and from the towns near Boston, which would otherwise be carried directly into the market by teams as now done, which would be cheaper and safer than to pay double transportation, first, to the rail-way, and then from the store houses to the market and stores of the merchants; as *the expense of transporting goods from the vicinity of the market to the proposed store house by Charles street, with trucks and carts would exceed the cost of transportation on the rail-way twenty miles.*

A great advantage likewise would be gained in the conveyance of passengers, the cars for their conveyance being enabled to start from the centre of the city; as all who have had occasion to go in our packets and steam-boats, know the great inconvenience of being obliged to go to them at a remote part of the city. We know that all improvements the more they can be brought to notice, and their advantages seen and felt, the more they will be patronized, and if you can say to the merchant, manufacturer or mechanick, We will take your goods from your doors, place them in our cars under your own inspection, and without further trouble to you, transport them to the place where you request, in half the time, and for half the money, you can get them transported by any other conveyance; I ask, would you not double your chance of inducing him to send his goods by the rail-way, to what you would if you said to him, Send your goods to our ware house and they shall be carefully stored until our cars are ready to take them, and then they shall be forwarded. Another source of con-

siderable revenue, if the rail-way is brought to the centre of the city, which would otherwise be lost, would be in the conveyance of light goods, and small parcels, which would pay a high freight, and would go by other conveyances if they were to be sent any considerable distance to the cars. Another very important consideration is the great advantage of connecting directly the rail-way with the navigation, whereby many heavy articles can be delivered on board the ships and vessels and transported to other ports; which an additional charge for truckage would nearly or wholly exclude from being an article of exportation, such for instance, as slate, granite, soap stone, coal, &c. By adopting the proposition under consideration, a large proportion of the ware houses and expenses incident thereto would be dispensed with, which, with the cost of the land and buildings, would fully equal and probably exceed the expense of the rail-way tracks through the streets, and without answering so valuable a purpose, and the uniting the northern and western rail-ways, and bringing them into the city, would greatly reduce the expense of construction to each.

I therefore cannot but think, that when the proper time arrives for the location of rail-ways to this city, the considerations here suggested, with others that might be brought forward, will not fail to receive the attention which they may deserve. F.

THE SILK WORM.

In our last number we gave some account of the growth and manufacture of Silk. We have now before us a very interesting work by the Count Van Hazzi, of Munich. He had seen the resolution of the American House of Representatives, referred to in our last number, and being desirous of promoting the patriotick views of the House, sent the result of his labours as an evidence of the good will he bears to the United States. From this valuable treatise, we now lay before our readers an extract from the chapter on the natural history of the Silk Worm.

"When the worm is first hatched, it is very minute, and of a brown hue, if healthy. This hue is derived from the hairs covering its body; they disappear in the course of a few days, when it assumes a light or dark hue, according to the nature of the particular variety. Behind the head, the skin is formed into six wrinkles. The body is composed of twelve articulations or rings; each ring, except the second, third, and last, is marked on the sides, and near the belly, with spots of a deeper colour than that of the skin, and show oval openings through which the insect respires. These openings are termed spiracula, or breathing-holes, and communicate, internally, with two air vessels, running the whole length of the body, one on each side, in a straight line, from one spiracle, or stigma, to another, and uniting, near the head, form one trunk. They serve, or perform, the office of lungs. In other words, these stigmata are eighteen mouths, which admit air into the principal air vessels in the large trunks of the trachea, or wind-pipes, whence it is led to the different and numerous ramifications of the air tubes, to the intestinal canal, to the other internal parts, and to the skin.

The silk-caterpillar has sixteen feet. The three first pair are scaly and hard, and placed under the three first rings, one on each side. The next two rings are destitute of feet. The four succeeding rings have each two feet. Those are soft and membranous, and swell, contract, and expand, at the will of the insect. The next two rings are without feet; the last ring has two feet. The extremities of the twelve membranous feet are furnished with hooks, or claws, the number of which, according to the accurate Malphigi, are forty in number in each foot. They are of different sizes, and are placed in double and equi-distant rows. The extremities of the six first feet consist of curved nails, or hooks, which enable the caterpillar to hold to the spot to which it has been pushed by the contractions of the posteriour rings. These feet are the envelopes of those which appear in the moth. The others remain with the cast-off skin of the caterpillar.

On the last ring but one is placed a small horn, if that can deserve this name, says Reaumur, which is used neither as a weapon of attack nor defence. This accurate naturalist acknowledges his inability to point out its use. The head of the caterpillar is formed of two scaly spherical pieces, which do not touch, but leave a triangular space between them. On each side of these pieces, and in front, six or seven black spots, arranged in a circle, may be seen: these are the eyes. The opening between these two pieces, below and in the forepart, is the mouth. It is armed with two parallel jaws, and with teeth, which move horizontally when the insect eats. The spinnaret, or silk hole, is near the summit of a pyramidal substance, occupying the middle of the lower lip, and terminates in a little papilla of a black form, from the point of which the silk filament issues that forms the cocoon. The canal which receives the aliment, proceeds in a straight line, from the mouth to the vent, and is of different capacities, analagous to the gullet, the stomach, and intestines, of animals. The vessels in which the silk is formed, consist of two parallel tubes of the same size, which are so

extremely delicate, near their termination, as to appear to unite in one tube; but, by immersing and hardening the insect in spirits of wine, Reaumur found that they continued separate to their ends, and that he could take them out entire: they are about one foot in length. The use of the microscope confirmed the structure: for, by the help of this apparatus, he discovered that the fibre of silk, minute as it is, instead of being round, as it would be if it proceeded from one vessel, had more breadth than thickness, and that in the middle of each fibre, there was a kind of furrow, giving the appearance of two flattened cylinders glued together. In some threads, he even saw the separation, or forks, at the end of the thread. From the contracted nature of the sides, and the form of the orifice, combined with the power the insect has of moving it in every direction, results the difference we see in the breadth and form of the threads, and the various thickness of the same thread.

The silk reservoirs, following the course of the stomach, extend as far as the last pair of membranous feet, then fold back on each side, and proceed to the head, and after two more turnings, the tubes lessening in size, they end in a series of convolutions. Each of these vessels are filled with a glutinous matter, near the time of spinning the cocoon, generally, of the colour of the silk, which the caterpillar will spin. Sometimes it is of different colours in the same vessel; the upper part containing a yellow liquor, and the lower portion of it a pale liquor. The quality of the leaves, and the constitution of the insect, are the probable causes of this circumstance. While in the silk-secretors, it assumes the appearance of a viscid gum; but the moment it is exposed to the air, after being thrown out by the worm, it dries and hardens into a single thread.

The silk caterpillar, whose life is one continued succession of changes, casts off its skin four times before it reaches its full growth. This is a wonderful provision of nature, (although, as is well known, not confined to this insect,) to relieve itself from the constriction it suffers from the skin, which does not expand in proportion to the gradual increase of its body. These changes are times of pain to the caterpillar, which it shows by a state of languor, and by ceasing to eat. It prepares for the operation, by emptying the intestinal tube, and by throwing out, at different parts of its body, silky fibres, and attaching them to the litter of its food, in order that, while it exerts itself, the skin may remain fixed in the spot where it is placed. The insect is now seen, at intervals, with its back elevated, or with its body stretched to the utmost extent, sometimes raising its head, which is swelled and pointed, moving from side to side, and then letting it fall. Near the change, the second and third rings are seen considerably swollen.

By these internal efforts, the old parts are stretched and distended, and a slit is made on the back, generally beginning at the second or third ring. The new skin may now be perceived by its freshness and brightness of colour. The caterpillar then presses the body into this opening, by which means, and a continuance of swellings and contractions, a rent is made from the first to the fourth ring. Then, bending the forepart of its body, and drawing it backwards, it disengages the head from its old covering, and throws it out of the slit. Finally, curving the posteriour rings, and drawing them towards the head, the whole body escapes from its sheath. This escape is facilitated by a moisture, which the insect emits and diffuses over its body.

This laborious operation is the work of an instant; and the skin, when cast off, is so entire, that it might be mistaken for the larva or caterpillar itself, comprizing, not only the covering of the trunk, but of the very skull, eyes, jaws, and legs. These changes are termed moultings, and take place at different intervals, and continue for various periods, according to the climate or temperature in which the insects have been kept, their particular nature, the quality of the food, and the quantity and regularity with which they have been supplied. In this country, in a general way, the silk-caterpillars of four casts or moultings, which have been, in all respects, properly treated, show symptoms of their first moulting on the fourth or fifth day after they are hatched.

Sometimes a part of the covering remains attached to the extremity of the caterpillar, which it cannot cast off. The insect then swells or enlarges in the part which is disentangled, while the other part of the body continuing compressed, occasions its death."

GRECIAN ARCHITECTURE.

Those of our readers who attended the interesting Lectures on this subject by Mr. Everett at the Atheneum Hall before the Massachusetts Mechanick Association will not be uninterested in the following extract from the Edinburgh Review, of "An Essay on the Nature and Principles of *Taste*; by A. Alison, F. R. S."

"There are few things," says the Review, "about which men of *virtu* are more apt to rave, than the merits of the Grecian Architecture; and most of those who affect an uncommon purity and delicacy of taste, talk of the intrinsick beauty of its proportions as a thing not to be disputed, except by barbarian ignorance and stupidity. Mr. Alison, we think, was the first who gave a full and convincing refutation of this mysterious dogma; and while he admits, in the most ample terms, the beauty of the objects in ques-

tion, has shown, we think, in the clearest manner, that it arises entirely from the combination of the following associations:—1st. The association of utility, convenience, or fitness for the purposes of the building; 2d, Of security and stability, with a view to the nature of the materials; 3d, Of the skill and power requisite to mould such materials into forms so commodious; 4th, Of magnificence, and splendour, and expense; 5th, Of antiquity; and 6thly, Of Roman and Grecian greatness. His observations are summed up in the following short sentence.

'The proportions,' he observes 'of these orders, it is to be remembered, are distinct subjects of beauty, from the ornaments with which they are embellished; from the magnificence with which they are executed; from the purposes of elegance they are intended to serve, or the scenes of grandeur they are destined to adorn. It is in such scenes, however, and with such additions, that we are accustomed to observe them; and, while we feel the effect of all these accidental associations, we are seldom willing to examine what are the causes of the complex emotion we feel, and readily attribute to the nature of the architecture itself, the whole pleasure which we enjoy. But, besides these, there are other associations we have with these forms, that still more powerfully serve to command our admiration: for they are the GRECIAN orders; they derive their origin from those times, and were the ornament of those countries which are most hallowed in our imaginations; and it is difficult for us to see them, even in their modern copies, without feeling them operate upon our minds as relicks of those polished nations where they first arose, and of that greater people by whom they were afterwards borrowed.'

This analysis is to us perfectly satisfactory. But, indeed, we cannot conceive any more complete refutation of the notion of an intrinsick and inherent beauty in the proportions of the Grecian architecture, than the fact of the admitted beauty of such very opposite proportions in the Gothick. Opposite as they are, however, the great elements of beauty are the same in this style as in the other,—the impressions of religious awe and of chivalrous recollections coming in place of the classical associations which constitute so great a share of the interest of the former. It is well observed by Mr Alison, that the great durability and costliness of the productions of this art, have had the effect, in almost all regions of the world, of rendering their fashion permanent, after it had once attained such a degree of perfection as to fulfil its substantial purposes.

'Buildings,' he observes, 'may last, and are intended to last for centuries. The life of man is very inadequate to the duration of such productions; and the present period of the world, though old with respect to those arts which are employed upon perishable subjects, is yet young in relation to an art which is employed upon so durable materials as those of architecture. Instead of a few years, therefore, centuries must probably pass before such productions demand to be renewed; and long before that period is elapsed, the sacredness of antiquity is acquired by the subject itself, and a new motive given for the preservation of similar forms. In every country, accordingly, the same effect has taken place; and the same causes which have thus served to produce among us, for so many years, an uniformity of taste with regard to the style of Grecian architecture, have produced also among the nations of the East, for a much longer course of time, a similar uniformity of taste with regard to their ornamental style of architecture; and have perpetuated among them the same forms which were in use among their forefathers, before the Grecian orders were invented.' "

MATHEMATICKS.

"The study of Mathematicks, when rightly conducted, ought we presume, to aim at two capital objects. It should not only lead to an intimate acquaintance with those relations of figure and quantity, which are so highly instructive, and confer such immediate and important advantages in the business of life, and the prosecution of the physical sciences; but it should also train the mind to the invaluable habits of patient attention, accurate arrangement, nice discrimination, and close reasoning. This latter advantage, in the view to general education, is perhaps the most essential. The number of those who have leisure, taste or capacity, to devote themselves to the prosecution of abstract researches, however splendid and imposing, must necessarily be very limited; but all who, in every condition of society, aspire to the liberal and cultivated exercise of their faculties, will derive inestimable benefit from that previous discipline of the understanding which the study of the mathematicks appears so admirably fitted to bestow. On this account, we are persuaded

that a young man will reap more essential and lasting knowledge from an acquaintance with geometrical reasoning, than from a knowledge of the elements of algebra. The latter may help to improve his dexterity in ciphering, and better prepare him for entering on the details of business; but the former, besides the practical skill which it cannot fail to impart, has a direct tendency to invigorate the whole of the intellectual powers, and to lay a sure and solid foundation on which to erect future superstructures. After such habits of cautious procedure and accurate discrimination are once formed, the student may safely venture into the region of modern analysis, and range with profit through that boundless domain, where so much is admirable, and so much is yet clouded with obscurity, or disfigured by hasty and careless combination.

Archimedes may justly be regarded, on the whole, as the most inventive philosopher that has ever appeared. Born in the island of Sicily, where Grecian colonies had carried the liberal arts to a very high pitch of improvement, he discovered an early passion for knowledge and elegant science; and, following the impulse of his inclination, he repaired to Egypt, and completed his education at the Royal establishment of Alexandria, the great seat of mathematical learning, which, in every branch, had for ages flourished under the munificent patronage of the Ptolemies. On his return to Syracuse, he devoted himself entirely to abstract research; and having, by his creative genius, improved the method of geometrical analysis, he now carried that refined instrument beyond its ordinary limits, and investigated, with the happiest success, the relations of curved lines, surfaces, and solids. He measured the parabola; approximated to the quadrature of the circle; investigated the properties of spirals and conoids; assigned the superficial extent of the spherical zones, and determined those fine proportions which connect the sphere with the cone and cylinder. In his *Arenarius*, he has pushed to vast extent the ideas of arithmetical notation; and seems almost to have there anticipated, in some degree, the sublime invention of logarithms. Such abstruse discoveries required, at that early period, the most intense application of thought. Archimedes did not, however, confine his views to mere speculation; but, embracing the widest range, he particularly cultivated those objects which are of most importance to a maritime and commercial state. He established the true principles of Mechanicks, laid the foundation of Hydrostaticks, and, by assigning the position of the centre of gravity in a variety of figures, and fixing the circumstances which determine the stability of floating bodies, he traced out the first rudiments of naval architecture. His talents and inexhaustible resources as a practical engineer, suspended the fall of Syracuse, and enabled that petty state to resist successfully, for the space of three whole years, the most strenuous efforts of Roman power. The philosopher was not doomed to survive the independence of his native country; but perished amidst that scene of horrour and indiscriminate carnage which closed on the fatal assault."—(Edinburgh Review.)

VENTILATION.

On this highly important, but very much neglected subject, we have selected the following from the New-York Mechanicks Magazine, believing it to be applicable to this section of the country.

"There is no subject more worthy the attention of the publick than the very ineffectual methods in common use to warm and ventilate our apartments, and the very common complaint of smoky rooms, and draughts produced from the wrong position of doors and windows, which subject us to the alternative of being stifled by the one, or chilled by the other. Indeed I have been often surprized that, among all our modern improvements in buildings, so little has been done with regard to the inconvenience felt under the present system; many methods have, indeed, been proposed for warming our workshops and manufactories, but few of general application to domestick purposes. I am, therefore, induced to call the attention of your numerous correspondents to the subject, in the hope that some general plan may be adopted for the comfort of us all. I would recommend to the perusal of the publick in general, some plans laid down in a pamphlet lately published, on the different systems of Warming and Ventilating Buildings, addressed to the economist, the invalid, the desirer of safety, and the lover of comfort, by G. P. Boyce. An extract or two from this production may not be uninteresting; indeed the whole is written in a style that at once commands our attention, and convinces us by its reasoning. At page 11, the author observes—"That the present mode of obtaining warmth is defective in an eminent degree, every one, however unwilling to confess himself in errour, must be innately conscious. A more bungling and inefficient process was, perhaps, never devised, than that by which it is attempted to raise the temperature of an apartment by means of

an open fire in a grate and chimney of the modern construction; nine-tenths of the heat produced by the one, being, from the very nature of things, immediately carried off through the channel of the other; and the remaining tenth, slowly communicated to the air of the apartment, is just sufficient to convert every aperture and crevice into a trap for colds, fevers, rheumatism, and all the disorders arising from a checked perspiration."

Again, speaking of combustion and the necessity of a supply of oxygen to maintain it, he says—"The fire or combustion in the grate is continually drawing to itself fresh supplies of atmospherick air, and consequently the radiation of heat in those directions is completely checked and overcome by the superiour force of the cold current which, as fast as the supply undergoes the calorifick process, becomes rarified, ascends, and is wasted through the above channel of the chimney."

The remarks of the author on the disfiguration of our buildings by the pile of chimneys, always visible, are worthy the attention of the builder and architect.

"I shall now conclude this article by remarking, that, if through the medium of your useful publication I should draw the attention of the ingenious mechanick to a subject well worthy his consideration, I have only done that which a lover of his country should strive to accomplish—the general diffusion of useful knowledge, and the improvement of our arts and manufactures. G. A. S."

We have looked into Mr. Boyce's pamphlet, and concur entirely with our intelligent correspondent in the praise which he bestows upon it. It is very sensibly and ably written, and we are tempted to add to the preceding extracts the remarks to which G. A. S. alludes, on the effect of piles of chimneys in disfiguring our buildings; they contain some well-pointed satire.

"The want of artificial warmth must have been early felt by man, and the art of procuring it may, perhaps, claim an antiquity beyond the age of architecture. The half-clad savage of the colder regions, employed all day in the chase, found, at night, the blazing fire necessary to his very existence; and it was to protect this preserver from the vicissitudes and inclemency of a northern sky, that, at a future period, he surrounded it with walls and a roof, and thus became an architect. When the smoke in this confined situation began to produce him annoyance, a central opening in the roof afforded slow egress to the cause of his discomfiture; and his easily satisfied imagination deemed itself to have now reached the summit of domestick enjoyment. Such were the habitations of our forefathers for many succeeding ages; and erections of this primitive structure may even yet be found in the wilds of America, among the mountains of the north and in the bogs and fens of a sister country. But as luxury and civilization arose, and buildings began to assume more durable and complicated forms, other modes for the supply of warmth became necessary, and other contrivances to that end were to be introduced. Throughout these changes, the due arrangement and disposition of the several fires seem to have been the stumbling block of our early architects. With some fearful ideas of the consequences to be apprehended from confined smoke, the wide-spreading arches and massy piles they constructed to facilitate its escape, appear, in many instances, to have occupied half the space, and to have cost nearly half the expense of the entire building. Some enormous specimens of this period yet remain, presenting the appearance more of immense natural chasms than of chimneys, frequently exciting the surprize of the antiquary by their unaccountable proportions. The quantity of heat and of unconsumed materials daily wasted through these preposterous cavities, would madden a modern economist; but when lands were to be cleared, and forests hewn down, an arrangement which so admirably assisted these ends, by its extraordinary consumption of fuel, could not easily be dispensed with. As woods disappeared, and the means of supporting this waste became more expensive, it was found necessary to contract these vast recesses and erections; so that, after a long contention, the arch of the fire place no longer vied in magnitude with that of the great church door. In this state the practice has descended to modern times. One slight approximation to a better principle the last century certainly introduced; as from an attention to the laws which regulate the motion of fluids, it was then discovered that a small chimney, by means of its quicker draught, carried off the smoke quite as effectually as by the sluggish motion in a large one. But the original principle, with all its overwhelming errours, remained unaltered: this quicker draught carried off with it still greater quantities of unconsumed fuel; the beneficial effect of the fire was still circumscribed to a space of a few feet from the grate, and the air, necessary to support combustion, continued to be drawn into the apartment from the external atmosphere, consequently at such a temperature as completely to neutralize what portion had already received the calorifick influence."

HISTORY OF CANALS.

The following has never been published, we believe, only as it was contained in a long Report of the Committee to the Legislature of Massachusetts on the subject of the Canal in contemplation some three or four years since. The Committee went at large into many interesting details, among which was that of the *history of canals*, and from which we have selected the following brief article.

"In the Delta of Egypt and the plains of Babylon are to be traced the vestiges of the first canals which were constructed. Primarily they were merely small channels cut for the purposes of agricultural irrigation;—conducting the waters of the Nile, Euphrates and Tigris through the fertile fields of those

once flourishing empires. But ultimately they were extended in length, width and depth, and became subservient to navigation; still, from the topographical features of those countries, neither locks, aqueducts nor tunnels were required, as they were generally straight excavations, of one level, through which the water uninterruptedly flowed. In Venice and Holland similar canals were early made, and it was not until towards the close of the fifteenth century, that locks were invented by the brothers Dominico, the celebrated civil engineers of Stra, near Viterbo, in Italy.

The first canal, furnished with locks, completed out of Italy, was that of Briare in France, between the Loire and Seine, during the reign of Lewis XIII; but the first canal in which locks, aqueducts, tunnels, artificial reservoirs, deep cuts, embankments, and, in fact, all the modern improvements were introduced, was that of Languedock, commenced in 1667 and finished in 1681. Here all the talents and resources of the engineer were laid under requisition, and his art exhausted; for rivers, valleys, and mountains were to be passed, and water conducted from a great distance to supply the canal. Many other expensive canals have since been constructed in France.

Eighty years after Riquet had commenced the Languedock canal, the illustrious Duke of Bridgewater, "justly styled the father of British inland navigation," commenced his canal, which was finished in 1776. This successful experiment was speedily followed by numerous companies; and within fifty years, more than one hundred canals have been made in England, the total extent of which is 2682 miles, and cost upwards of 132 millions of dollars, which yield an average income of over ten per cent. on the investment, and many of them a much greater profit.

The canals and hydraulick works in the north eastern district of Holland alone, between the Dollart and the Scheldt, have been estimated to have cost 1,332,000,000 dollars.

In Russia, since the accession of Peter the Great to the Imperial Throne, inland navigation has been so far extended, that goods can be conveyed from the frontiers of China to St. Petersburg, a distance of 4472 miles, with a land carriage of only sixty miles; and from Astracan, on the shores of the Caspian Sea, through a tract of 1434 miles.

Such are the triumphs of genius and enterprize, within the brief period of our national existence."

COMMUNICATION.] [FOR THE MAGAZINE.]

WELDING IRON AND STEEL.

SIR,—I send you the following, which originally appeared in this town some years since, in a work of like character with yours, and which I esteem of sufficient importance to entitle it to a place in your Magazine. Many times the facts therein stated, exist, when the smith is often ignorant of the remedies to apply.

"As iron and steel are compounded more or less with sulphur, copper, and arsenick, which if they predominate too much, will prevent their being welded sound, it may be of some importance to blacksmiths to know what remedies to apply in such cases. When iron is compounded with sulphur, it is apt to burn before a welding heat can be raised. In this case a little unslacked stone lime should be pounded up very fine to be used instead of sand. Lime will absorb the sulphur and enable the smith to weld it sound. If but a small quantity of copper enters into the composition of iron, it will render it brittle when hot, and tough when cold. In this case salt, or salt-ammoniack, should be used with the sand, which will evaporate the copper and prevent the iron from breaking when it is very hot. Arsenick generally predominates in iron that is very brittle when cold. A small quantity of saltpetre should then be used with the sand for welding. Iron or steel that is entirely free from either of these pernicious substances will work sound, weld with ease, and be very tough when cold. This is what is called good iron. The same may be said of steel.

A fault too often found with blacksmiths is, that their work is not *sound*, when in fact the fault is in the iron they have to work. A little attention to ascertain the qualities of iron, and to apply the proper remedies, will enable them to make their work sound, or, at least, as good as the quality of the iron will admit. In welding iron and steel together for edge tools it will be of service, (at least it can do no harm even if the iron and steel is ever so good,) to have a little lime, salt, and saltpetre mixed with the sand commonly used in welding. This mixture makes an excellent flux for welding, and at the same time prevents the iron from burning, and enables the smith to raise a sufficient heat to weld it perfectly sound, even to the very centre of the bar."

COMMUNICATION.] [FOR THE JOURNAL.

CANADA ROAD.

This great enterprize, it is understood, will be completed in all the present year; indeed it is under contract to be opened by November next, and from the strong interest which Maine has in its completion, leads us to expect there will be no failure of it. The Canadians nearly constructed theirs a long time since from Quebeck to the boundary line. It is for a considerable part of the way, a most excellent road. We believe the land is cleared four rods in width, and the travelled road is one rod—a handsome turnpike. Col. Lewis, on the part of Maine, and Mr. Hall, Surveyor-General of Lower Canada, agreed upon the lines of division, in 1818 or 19. From thence the road comes to Concord, a town in the Bingham Purchase, on one side of the Kennebeck river, and to Moscow on the other side, and from thence through the following towns: Anson, Starks, Norridgewock, Waterville, Sidney, and Augusta to Hallowell. It may not, perhaps, be borne in mind by all our readers, that a Resolve passed the Massachusetts Legislature, June 12, 1817, appropriating the sum of five thousand dollars towards the construction of that part of this road which passes through the Bingham Kennebeck Purchase, so called, under and by virtue of the powers vested by law in the County Court for the counties of Oxford and Somerset. In June 1827, this state, by another Resolve, granted a township of land, on condition "that the state of Maine shall, within two years, make a road from the north line of the Bingham Purchase to the north line of the state of Maine, so that travellers with their horses and carriages may safely pass therein."

The state of Maine having all those obstacles to contend with which are incident to the construction of new roads through a wilderness country, and particularly in a work of such magnitude as the present, finding that the enterprize could not be completed within the time specified in the Resolve, subsequently obtained further time; and this expires, as was stated in the beginning of this article, the ensuing November. We are thus particular, that the citizens of Massachusetts may know what a considerable enterprize they have been aiding; that it is a part of their own property; and that they may feel to have an interest in it; that they own lands along on said road; that the road passes the finest mill privileges; and over hills of ores of different kinds; and besides, and more than all, that they may be led to reflect, what we believe they never have sufficiently done, the immense trade which is about to be opened immediately upon Maine, and hence, the great interest we have in Boston of giving a new impetus to our steam navigation, with Portland, Bath and Hallowell.

Some of our readers will, we know, be gratified by an extract from the notes and barometrical observations of captain Alden Partridge, of the U. S. Corps of Engineers, taken by one of the Cadets, and by whom we have been favoured with it. It shows the distance of one place to another, and the altitude of the various sections or stations, and is as follows:—

Distance in Miles.	Altitude in Feet.	Names of places at which the altitudes were taken.
		Surface of the St. Lawrence.
½	200	
11½	223	St. Henry.
9	495	St. Etienne.
2	471	River Chaudiere.
7	532	St. Marie.
12	468	St. Joseph.
9	570	St. François.
12	620	Aubert Gallion.
12	900	
10	973	Indian river.
11½	1748	[lands.
1	2002	Monument on the high
4	1683	Branch of the Penobscot.
3	1932	1st Height of land south
2½	1821	[of the monument.
1¼	1577	
3¼	1519	
2½	1395	
1½	1241	Moose river.
3	1473	
2	1764	[of Moose river.
2	2082	1st Height of land south
2	1983	
1	1631	
3¼	1575	
2½	1862	2d do.
1½	1469	
9	640	Dead river. [nebeck rivers.
2	570	Forks of the dead, & Ken-
10	555	Upper Settlement on the
14	456	Bingham. [Kennebeck.
14	409	Village of Anson.
12	360	Norridgewock.
12	228	Fairfield.
10	219	Waterville.
10	201	
10	25	Hallowell.

The distance from Boston to Quebeck may be laid off as follows—say,

To Hallowell	173	miles
" Fork of the Kennebeck . .	78	"
" Canada Line	43	"
" Quebeck	86	"
Total	380	"
" Present U. S. mail distance	488	"

Making a clear saving of 108 miles in the distance between the city of Boston and the city of Quebeck on the opening of the new road the present season.

The quantity of land in the state of Maine, owned by Massachusetts, is not far from five millions of acres. The quantity in dispute, belonging to both states, is about 3,000,000 acres, leaving possibly, but not probably, to come from the five millions, one and a half millions.

This interest of the state, and still greater interest of the city of Boston in the new road, and the eastern trade generally, will make the subject of another communication.

ON THE EARLY HISTORY OF

STEAM, AND STEAM ENGINES.

The origin of any thing which either has been attended with, or is likely to produce to us, great and lasting benefits, very naturally elicits our attention and becomes to us an object of deep interest. The origin of steam, or of the application of steam, to the operations of an engine for any purpose must very naturally attract our regard, and lead to a desire to be made acquainted with every thing which can be gathered from any intelligent source; and although the precise period of the discovery, or its author, either of one or the other, may not be arrived at, nay, may even be the subject of an animated dispute, still the researches of the scientifick into the various views of those whose pens have been thus drawn out in its discussion, become interesting and instructing; for who can at all wonder that such immense discoveries should thus become subjects of sharp disputes, that not only writers of extreme sections of the same country, but even those of whole countries should be engaged in this dispute—that nations should be found carrying on the warfare of controversy, and after hundreds, if not thousands of years, the subject should still, in the minds of all, not be satisfactorily settled.

In the two numbers of the Franklin Institute, for November and December, we meet with an interesting article on this subject, and from which we shall make a few extracts.

"In England you will be told that the first inventor of the steam engine was the Marquis of Worcester. Every where this name will be cited, and it will be followed by those of Savery, of Newcomen, of Beighton, of Watt, of Hornblower, of Woolfe, &c. &c. Literary men, and those who cultivate the sciences, have, in general, opinions no less decided. If you open the recent Encyclopædia of Dr. Rees, you will find this passage; 'the steam engine follows next to the ship in the order of inventions, but in an English Encyclopædia it will take the lead, from the circumstance of its being wholly invented and brought into general use by our own countrymen.' And then, as if this were not sufficiently clear; 'the steam engine has been invented by a small number of individuals, all of them Englishmen.'

The earliest known suggestion, for the use of steam, says the Institute, is one made about one hundred and thirty years *before Christ*, by Hero, of Alexandria, and published in his 'Spiritalia.'

A translation of the work of Hero was published in Italian by Baptista Porta, in 1606. He repeats Hero's inventions, and adds one of his own, illustrated by a diagram, in which is shown the furnace for heating the water.

Only nine years after the publication of the work of Baptista Porta, that is to say, in 1615, appeared a treatise on *Moving Forces*, and especially on the means of raising water. The author does not profess to give new inventions, nor is there the slightest reason for ascribing to him *that* which will be presently considered. He says, 'there *are* five means of elevating water above its level,' which means he then describes, and which were then all of them old, most of them 2000 years old. They are, in fact, brought forward as *existing* inventions, and some are expressly referred to their authors.

The *first* mode of raising water, he says, is by the syphon. This instrument was older than Hero.

The *second* is by the well known operation of capillary attraction.

The *fourth* is by the action of compressed air, illustrated by Hero's fountain, and ascribed to Hero.

The *fifth* is by animal labour applied to

machinery, such as the screw of Archimedes, or the pump of Ctesibius.

It would evidently be absurd to call the writer of the book in question the inventor of any of the four apparatus above described. He himself makes no greater claim to the third than he does to the others, and the works of Hero and Porta show that he *has* no claim; yet it has been very improperly conceded to him by several English writers.

We now approach the period at which France invented the steam engine. The work was written by Salomon De Caus, whose name and pretensions were familiar as household words to the English, through the medium of English books, for years before M. Arago rescued them from the oblivion in which he says English prejudice had buried them. But to return to the fact that the steam engine is on the point of being invented in France by Salomon de Caus.

The invention of this mighty agent, and its announcement to the world, fully justify the epithet which M. Arago gives to the inventor, when he calls him the 'modest Salomon De Caus.'

The announcement forms the *third* of the means which De Caus says *are* in existence for raising water.

'The *third* means is by the aid of fire, for which various machines may be made;' and he proceeds, 'I shall here give the demonstration of one. Let there be a globe, having a valve, to introduce water, and a tube, soldered into the upper part of the ball, and descending nearly to the bottom; after having filled the ball with water, and well closed the valve, place it on the fire; then the heat, acting on the ball, will cause the water to ascend through the tube.'

Nothing can be better than this as an illustration, in a general treatise, of the means by which water may be elevated; and nothing could be more ridiculous than to put this forth in 1615 as an invention; for, during the previous fifty years, Europe had been deluged with translations of Hero, and only nine years before had appeared a full description of the apparatus of Porta, to which this is so obviously inferiour, that it would be an insult to the reader to say why.

In 1629, Branca, an Italian, describes an apparatus which he proposed. The boiler terminates with a bent tube, from which the steam issues, and impinges upon the vanes of a wheel, which receives motion in the direction of the arrow. There is very little novelty in this contrivance; the principle does not differ from the first apparatus of Hero, and the practical effect would probably be inferiour.

In 1663, appeared the 'Century of Inventions,' by the Marquis of Worcester; the following is a copy of that numbered 68.

This apparatus, is, in principle, the same as Porta's. The merit of the Marquis of Worcester consists in having suggested the use of highly elastick steam, in exceedingly strong vessels, so as to raise water to a useful height, as forty feet. He has also the merit of urging the adoption of this plan on the large scale, whereas the schemes of Hero and Porta were mere experimental toys.

On the whole, very little credit is due to the Marquis of Worcester. The majority of his hundred projects are either absurd or puerile: some are impossible to realize; many are not worth realizing; many contain no novelty; and several have a taint of perpetual motion. All this is so evident, that it would hardly have been thought worth while to mistranslate the Marquis, in order to make his one rational project as absurd as many of the others; yet this M. Arago does.

To proceed with the historical series, it may be mentioned, that about this time Otto Guericke was engaged in those experiments and speculations which led to the invention of the air pump,—to a better knowledge than had hitherto been obtained of the air's weight and elasticity, and, particularly, of the powerful effects of that weight and elasticity when excited by an exhausted, or partially exhausted, space.

Otto Guericke, in his work on the subject, published in 1672, describes numerous contrivances for exhibiting, or using mechanically, the weight of the air.

In this apparatus of Otto Guericke, which is fully described by a very large picturesque engraving in his work of 1672, we have a complete explanation of the principle of obtaining power from a vacuum formed under a movable piston. It is quite clear, also, that the mode of producing a vacuum by means of condensed steam, was known and published at this time. If, therefore, any one had proposed to Guericke, to make the vacuum by condensing steam, instead of by a pump, there would be no vast stretch of ingenuity in the suggestion. But suppose Guericke to reply, "how shall I apply

the steam?" Imagine, then, that he is thus answered:—"place a little water in the bottom of a cylinder, then set the cylinder on a fire till the water is converted into steam, and the piston is at the top; secure the piston from descending; and carry the whole apparatus to wherever the work is to be performed; then fix the cylinder; attach the piston to the point where your power is to be applied, and as the cylinder cools, your work will be done." If Otto Guericke were a man of business, he would reply, this will cost about ten times as much as exhausting the cylinder by hand. So that this suggestion, besides possessing the smallest possible quantity of originality, would have the property of being utterly inapplicable to useful or economical purposes.

About the year 1685, Monsieur Papin communicated to the Royal Society and others, various devices for using compressed and rarefied air to elevate water in jets or pipes. In none of these is there a particle of novelty, as will be evident to whoever will compare them with the works of Hero and his translators.

In 1669, Papin copied Otto Guericke's contrivance, and describes it as his own invention; whereas the only change he makes, is in causing the descent of the piston to express oil from seeds instead of raising a weight. This is a mere plagiarism.

From about 1685 to 1700, therefore, it appears that Monsieur Papin was engaged in forming contrivances to employ the force of exhausted or compressed air upon pistons in cylinders.

In 1688, he suggested the use of gunpowder to form the vacuum by its explosion, and in 1690, he proposed to form the vacuum by steam from a small quantity of water placed in the cylinder.

We proceed to the year 1699, when Mr. Savery exhibited to the Royal Society a model of the first engine, which is known to have been realized on the large scale.

In the year 1705, a patent was granted to Newcomen, Cawley, and Savery, for a steam engine, which was invented by the two former, and which was the first that ever became extensively useful; for Savery's was limited to inconsiderable heights, unless the vessels were subjected to dangerous pressures, and it was, moreover, very expensive in its consumption of coal. The machine of Newcomen and Cawley, is still partially used where coals are cheap.

The engine of Newcomen, which M. Arago admits to be the first that rendered any considerable services to industry, he describes as he does Savery's, without a diagram. He says, that "excepting some very essential details, it is nothing but the machine proposed in 1690 and 1695, by Papin." Excepting some very essential details, it is merely the machine of Hero. M. Arago never gives the slightest hint that he has put Newcomen's valve and boiler to Guericke's cylinder, and ascribed the combination to Papin; he says, that "both Papin and Newcomen produced the condensation by cold, though the English mechanick adopted a better plan of cooling for a working machine, than that which had been employed by Papin in his model;" and he proceeds, "The machine of Papin thus modified as to the manner of cooling the aqueous vapour, excited to the highest point the attention of the proprietors of mines."

In this last paragraph there is not merely a continued suppression of the fact, that the apparatus described as Papin's is not Papin's, but Newcomen's; there is a direct assertion that the two machines differed only as to the manner of cooling the vapour.

The "modification" which M. Arago thus misrepresents as to its extent, and which he accounts of so little consequence, made all the difference between exciting the attention of proprietors of mines, and exciting no attention at all. Papin's steam cylinder lay unnoticed and undisturbed, and apparently forgotten, not only by the world, but by Papin himself; for no sooner had Savery succeeded in perfecting and realizing his machine, than Papin abandons his cylinder, seizes on Savery's engine, mutilates it, and publishes it in 1707 as his own.

But, in fact, the steam engine was hardly yet invented. Newcomen's machine, though infinitely superiour to every former contrivance, is a crude, imperfect, wasteful apparatus, in comparison with those which the following century brought forth. The engine up to this time is scarcely worth a dispute, even if it had been produced wholly by one man; but it is obviously the result of a succession of improvements so inconsiderable, that the whole of them do not exhibit a tenth part of the scientifick and inventive resources which are displayed in the ameliorations effected by Watt alone. From the year 1705, the steam engine is confessedly a British invention. For all that is refined and economical in the developement and application of the heat; for all that is ingenious in the machinery; for

all that is vast in the power produced, and extensive in the purposes to which that power may be made subservient, it is notorious that the world is indebted to Great Britain.

COMMUNICATION.] [FOR THE JOURNAL.

PROPOSED

RAIL-ROAD TO VERMONT.

The friends of Rail-Roads can strike upon no section of New-England, northwardly, without observing the probable immense trade which would flow into this city upon the road, the very first day it might be opened for travel. Take for example the proposed route from this city to Brattleborough, and what do we find to be the very probable result? Why, it is this: That this road will be generally used by about one third part of Middlesex county; by about one half of Worcester county; by the whole of Franklin county; by some part of Berkshire county, especially by the sixteen or seventeen manufacturing establishments in North Adams; by about one third part of the state of Vermont; and by about one fourth part of the state of New-Hampshire. This calculation is made on the supposition that there will be no branches, and no extension beyond Brattleborough; should the road be extended to lake Champlain, it is not easy to conjecture what an extent of country may be induced to use it.

It is understood that the Connecticut river from Brattleborough, northwardly to Wells' river, in Barnet, is of easy navigation for boats of considerable burthen, for several months in the year. May it not be reasonably supposed that the coal mine, recently discovered at Bath, in New-Hampshire, which will find its way to the Connecticut by a land carriage of seven miles, a little below the entrance of Wells' river, will be brought to Brattleborough by the boats on the Connecticut, and from thence to Boston, over this road.

There can be no doubt that some 300 or 500 tons of copperas, made annually at Stafford or Thetford, in Vermont, ten or twelve miles from the Connecticut, and many miles below Wells' river, will find its way to Boston over this road; the soap stone from a large quarry about seven miles west of Bellows Falls, which has been worked for many years and transported down the river to Hartford, must also find its way to Boston over this road.

An establishment for making cast and wrought iron, which is now in full operation, under the direction of a spirited company, situated at Somerset, 25 miles westwardly of Brattleborough, promises considerable transportation to this road, as does also a manufactory of wrought iron at Hinsdale, in New-Hampshire.

Many latent objects of considerable value and great use, near the line and beyond the western *terminus* of this road, now lay dormant for want of a cheap mode of transportation, which would, on the completion of the road, be brought into active use, and thus furnish much employment, such for instance as inexhaustible quarries of white marble in Manchester, but forty miles from Brattleborough, over a road of easy passage; or some of the superabundance of wood in South Orange and Ewing's Grant, converted into charcoal and transported to Boston over this road.

All along the road, take any route you please, and business of every description presents itself to your notice. On the route, in the writer's view, say following the course of Col. Baldwin's survey for a canal as far as the mouth of Miller's river, besides the articles of hay, wood, and many other things, you meet with the article of lime at Bolton; slate at Lancaster; inexhaustible quarries of granite at Fitchburgh; hemlock bark, and the article of chairs, in very large quantities, at Ashburnham, for the Boston market; the transportation, each way, for about fifty manufacturing establishments, of various kinds; a number of paper mills; and a great number of stores all along the route, whose supplies and returns are very considerable, to say nothing of the trade of Brattleborough, and all the towns in its vicinity, and all along the valley of the river. The travel in stages, which is generally to be considered in making estimates of income on a Rail-Road on whatever route you may select, is here very great. I may at another time furnish particulars. The writer's interests are by no means identified with this route. He wishes to see one commenced somewhere or other; and wherever there is the greatest probability of getting the stock taken up, there let a charter be granted and the road immediately set about, as far at least as that preparations occupy the few weeks ere the season opens, and as soon as is proper, break ground and *complete* at least ten or twenty miles of the road this year, and say to the Legislature: There, gentlemen, we have made so many miles of Rail-

Road—there it is—it has *cost* us so much per mile—its *advantages* are as we have before told you; now will you, or will you not, take a concern in it? By this time, what with the demonstration above made, and the further favourable information which will be obtained from Baltimore—from Pennsylvania—from Liverpool and from elsewhere, the whole, together, could not but serve to awaken the state to a sense of its best and most lasting interests.

LEVER TRUSSES AND SLINGS,

FOR SHIPS.

(Concluded from p. 24.)

"On the new mode, combined with centre reeving, by means of a block, on a new construction, called a centre block, all these evils are removed. The yard turning upon its centre, it maintains the same distance from the mast and point of suspension in all its movements, whether vertical or horizontal. The yard, when bracing, turns in a horizontal plane and neither rises or falls, and no other power is to be applied, either in topping or bracing, than the weight of the yard, acting as a lever, itself requires; nor is there any of that wringing or twisting of the mast, when bracing the yard sharp, which is common to the old mode of rigging.

The advantage which this mode possesses over the old mode, when a ship is suddenly taken aback, or is brought by the lee in a gale of wind, or is placed in any other position when ease, certainty and expedition are required in bracing the yards, is very obvious. On the old mode, the wind pressing against the fore surface of the sail, urges the sail and yard against the mast and rigging; in this case the yard becomes a lever; the quarter, or that part which presses against the swifture, or mast, is the fulcrum; the yard from this quarter to the opposite extremity, and such part of the sail as is attached thereto, the weight, or resistance; and the force applied at the brace and acting at the other end of the yard-arm, the power. Hence it will be readily perceived, that this application of power is under great disadvantage, because it is applied to the shorter arm of the lever; and for this reason, combined with the resistance of the sails, occasioned by their being pressed against the rigging, mast and top, the difficulty, and at times the impossibility of moving a yard when a ship is placed in this situation, with all the force that can be applied, is owing. These evils may be considered in part, if not entirely remedied by the new mode. The yard being always kept at a distance from the mast by the truss, and moving upon a pivot, the action of the wind upon the fore surface of the sail and yard has a tendency to cause the yard to turn upon the pivot. The yard not being urged home against the mast, but preserving its distance, the sails are pressed against the mast, rigging and top with little or no force, and the great resistance from this cause is removed. Nor does the swifture act as a fulcrum on this plan as it does on the other: for the yard acts like a balance lever, the two arms of which are of equal length, and there is therefore no loss of power in this case; and the yard, when it comes in contact with the swifture, forms an angle with the keel of about 40 degrees. The additional time and labour required in preparing to brace about the yards, and the augmentation of power to effect this operation, in consequence of the resistance from these obstacles, are saved.

In support of these arguments, the loss of the homeward-bound Jamaica fleet, off the Banks of Newfoundland, under convoy of the *Ville de Paris*, of 110 guns, may be adduced. This fleet was lying-to in a heavy gale of wind from S. S. E. which suddenly veered to N. W. whereby they were taken aback, and nearly all perished. It is stated that no vessels escaped damage but those which were lying-to under fore and aft sails; and this fact proves either that the others were disabled or lost in consequence of the delay or the impracticability of bracing round the yards, either of which may be alike fatal, as the ship may be dismasted, and by stern-way she may founder. Hence it must be manifest to every reflecting and experienced man, that any contrivance, by which the yards of a ship, when placed in so critical a situation, may be wheeled about with less expense of time and power, and with greater certainty, must be of incalculable advantage.

It is universally admitted, that this improvement will be highly important, if the machine be sufficiently strong for the purposes it is intended to answer. It must be readily admitted, on the other hand, that it is of no importance if it cannot be made so. Let us, therefore, investigate this point. The theory of the strength of bodies for absolute strength is: '*that different bars of the same material are to each other as their transverse sections, whatever their shape or*

form may be.' The lateral strength of square or rectangular bars of the same materials, or the weight they will bear, *are directly as the breadth and square of the depth divided by the length, and cylindrical bars, as the cubes of their diameters.* By the experiments of Mr. Banks, which have been quoted with approbation by Dr. Hutton, (Hutton's Mathematicks, v. 2, p. 526) a bar of fir, an inch square and a foot in length, lying on a prop at each end, its strength, or the utmost weight it can bear on its middle is 400 lbs. and a bar of iron of similar dimensions and under the same circumstances, 2640 lbs. Hence for a ship's yard of 12 inches diameter and 48 feet long, we shall have by the rule $\frac{400 \times 12 \times 144}{48} = 14{,}400$ lbs. the strength of the yard at the centre, supported at the ends by the braces. The effect of wind upon a sail is always perpendicular to the surface of the sail and yard, when the yard is not parallel with its direction; and when the wind strikes obliquely upon the sail its force on the surface is to the force when perpendicular, as the sine of incidence is to radius. This effect of wind always brings a direct strain upon the truss, as the truss is always perpendicular to the yard, the yard being supported by the lifts, braces and top-sail sheets, that the effect of the lateral strain by rolling is very inconsiderable. Hence by wind and weather there is no great lateral strain, except upon the bolts which connect the truss together and confine the yard to the mast. This is the weakest part of the machine, and the smallest bolt for this purpose for the truss of a yard of 12 inches diameter is $1\frac{1}{2}$ inch; but this bolt, from its position, must be broken in two parts, if broken at all. It therefore is equal to one bolt of double the size, or a bolt of 1, 6 diameter nearly; but there is no augmentation of power by length, as there is no space between the power and resistance as applied to the bolt, it is therefore like a solid mass and nothing must be deducted for length. Then by the rule $\frac{2640 \times 1,6 \times 2,56}{1\text{-}12} = 129{,}757$ lbs. its strength. But the strength of the yard was 14,400 lbs. therefore the relative strength of the yard to the truss is as 14-129. This is on the supposition that the materials are free from defects, but the yard being a larger body is more liable to these evils, and by nature its strength is less uniform than that of iron, as it is affected by knots, and other irregularities in its growth. This disproportion between the strength of the yard and machine is to prevent its being injured by hoisting in long boats, anchors, or other great weight by the yard arm. The strain thus brought upon it is lateral and greater than any it has to sustain by wind and weather at sea, and as the weight acts upon a lever it is augmented, and the lateral pressure consequently increased. In some instances, when the yard was not properly secured for this operation, the truss has been bent by the stress which has been thereby brought upon it, and difficulty occurred with some of those which were first constructed in consequence of the bolt not being sufficiently strong to bear the strain, which was sufficient to alter the shape, and consequently to diminish its strength. And although the machine may be sufficiently strong, without this diminution, for all the purposes it is intended to answer, yet from this cause it may be rendered inadequate. In proof of which, in hoisting an anchor by the yard arm of a vessel fitted upon this mode, the truss was bent and partly fractured, but it was, notwithstanding, found to be sufficiently strong to endure the stress that was subsequently brought upon it by wind and sea. The mode of construction and proportions have been since altered, by which no such effect will hereafter be produced from the same cause. From these *data* we may conclude, that the new mode possesses the following advantages over the old:

1st. It is more safe.

2d. It is more durable and less expensive.

3d. It occasions less wear and tear to the hull, sails and rigging. And,

4th. A saving of time and labour.

S. A. W.

GREAT WESTERN RAIL-ROAD.

We are happy to lay before our readers a communication from De Witt Clinton, Esq., well known as an able and experienced civil engineer, to the author of a pamphlet published some months since, in which was proposed the establishment of a Rail-Road from this city (New-York) to the Mississippi, uniting all the natural and artificial channels of communication in the intermediate distance. The opinion of Col. Clinton will be regarded as the more valuable from being, as we understand, entirely unsolicited. The project here brought forward, is one of immense magnitude, and cannot be carried into execution without great expense and several

years labour. Nevertheless, the advantages which it would afford to agriculture and commerce, and indeed to every department of industry, are so great, that it ought not to be rejected without a fair examination.

According to the calculations of Col. Clinton, the expense of a rail-way on the route proposed, being upwards of 1000 miles in length, would be about $15,000,000; and notwithstanding its cost, would afford a liberal profit on the amount invested. If gentlemen are disposed to regard the enterprize as chimerical, they will please to recollect that the project of the Erie Canal, which has since so happily succeeded, was regarded as equally chimerical by the great body of the community, when first recommended by the honoured father of the gentleman whose letter we present.—Whatever may be the fate of the plan at present, we strongly suspect that at some future day, not very far distant, it will be executed, possibly with some variations in its details, and prove a source of wealth, prosperity and and power, to the states through which it passes, and indirectly to the nation at large. —(New-York Mercury.)

New-York, Dec. 24th, 1829.

Dear Sir,—With great interest I have perused your pamphlet containing a description of the route for a rail-way between the valley of the Hudson and the Mississippi.

The able arguments you have presented to the publick of the benefits and importance of the work, more than entitle you to the thanks of those who are interested in the success of the project, and your observations on the character of the country through which the road would pass, as far as my own knowledge extends, are correct; and I cordially agree with your opinion, that the work would be of general utility, as it would increase the commerce and prosperity of our sea-ports, and add, in times of war, to the protection of our country, by facilitating the transportation of munitions and implements of defence, and expediting the concentration of troops. The value of individual and publick lands would be increased, and also the harmony, and stability of the social compact of the states, by the union of their extensive artificial and natural channels of communication in one great system. It would aid in facilitating the transit of minerals, agricultural productions, and manufactured fabricks, from one extreme of the union to the other, and add generally to the happiness and convenience of a large portion of our fellow citizens, in possessing a route which could be used during all seasons of the year, and on which passengers and commodities could be transported with speed and certainty.

The length of the rail-way, between the two points, by your estimate of distances, is less than one thousand miles; but the work must encounter many physical difficulties, in crossing numerous valley-streams and ridges, and labour under many fiscal embarrassments on account of its cost.

Its completion, under these circumstances, will be considered by many individuals as dubious, and by others will be denounced as chimerical and impracticable, or be treated with ridicule. It will therefore be necessary for the advocates of this splendid and national work, to soothe opposition; strengthen the timorous, and silence the clamorous; to unite their views and influence; give the project stability in the publick mind, and weight in our national councils.

It will not probably be contended by the opponents of this project, that its construction will not equal the expectations of its projectors, in producing the most happy results to the country at large, but they will condemn its policy, under the influence of jealousies, and fears for other improvements which are completed, or in contemplation.

It may perhaps be considered by those who are interested in the success of this work, that the route ought to be confined to its junction with the Ohio canal. But they must perceive that you have not pointed out what ought first to be undertaken, but what can be done after that important link is completed.

The word practicable, as commonly applied to a canal or Rail-Road has reference to the physical execution of the project; but in a proper sense it can be used when the work does not present sufficient encouragement for capitalists to sustain it, or when the cost exceeds the ability of individuals, although the project may otherwise offer many inducements, and confer many blessings. There are, therefore, improvements of two descriptions,—national and private. The former promoting the general prosperity or adding to the means of defending the country; and the latter, individual emolument. Under each consideration the Rail-Road scheme is embraced, as it is worthy of governmental and individual support.

The government of the United States has already subcribed to the stock of the

Chesapeake and Delaware, the Chesapeake and Ohio, and the Dismal Swamp Canals; appropriated *monies* for the cleaning of the channel of the Ohio River; for the construction of a Breakwater at the mouth of the Delaware Bay, and sums for other works too numerous to mention; and it would be expected to manifest an equal interest in favour of the Rail-Road project.

The management and execution of the works present a subject for profound consideration, as it would have to be done either under the direction of a company incorporated by the joint acts of the several states through whose territory the route passes, or by a joint fund and Board of Commissioners appointed by the different Legislatures, or by each state constructing the section of road in its own jurisdiction, or the assumption of power for this purpose by the General Government. I should consider that either of the two arrangements mentioned first, would be the most proper, as the work would then come under one head,—a Board of Directors or Commissioners—which would insure union, and a single eye to the advancement and interest of the works; leave it open for the general and state government and individuals to become stockholders, and prevent the danger of collisions proceeding from interested motives, or difference of opinion respecting the rout to be adopted.

It cannot be supposed that any of the states interested in the route of the road, would refuse to incorporate a company for its construction. But should it prove to be otherwise, the company, by the purchase of land to be occupied by the works, would construct it, as is contemplated by the Susquehanna Rail-Road Company, if their application to the legislature of Pennsylvania should not succeed.

The route designated in your pamphlet, commences near the city of New-York, on the west bank of the Hudson, and crosses the ridges between the Delaware and Susquehanna. It then ascends the valley of the Tioga River, intersects the head waters of the Genesee and Alleghany, communicates with lake Erie, and passes the Cayahoga, Sandusky, Miami, Wabash, and other streams of great importance, and ends on the east bank of the Mississippi at the mouth of Rock River.

The length of the road is estimated at less than one thousand miles; and the country through which it passes, abounds with the richest mineral and vegetable productions, possesses a salubrious climate and a soil of exuberant fertility, and is irrigated by rivers of great extent and magnitude.

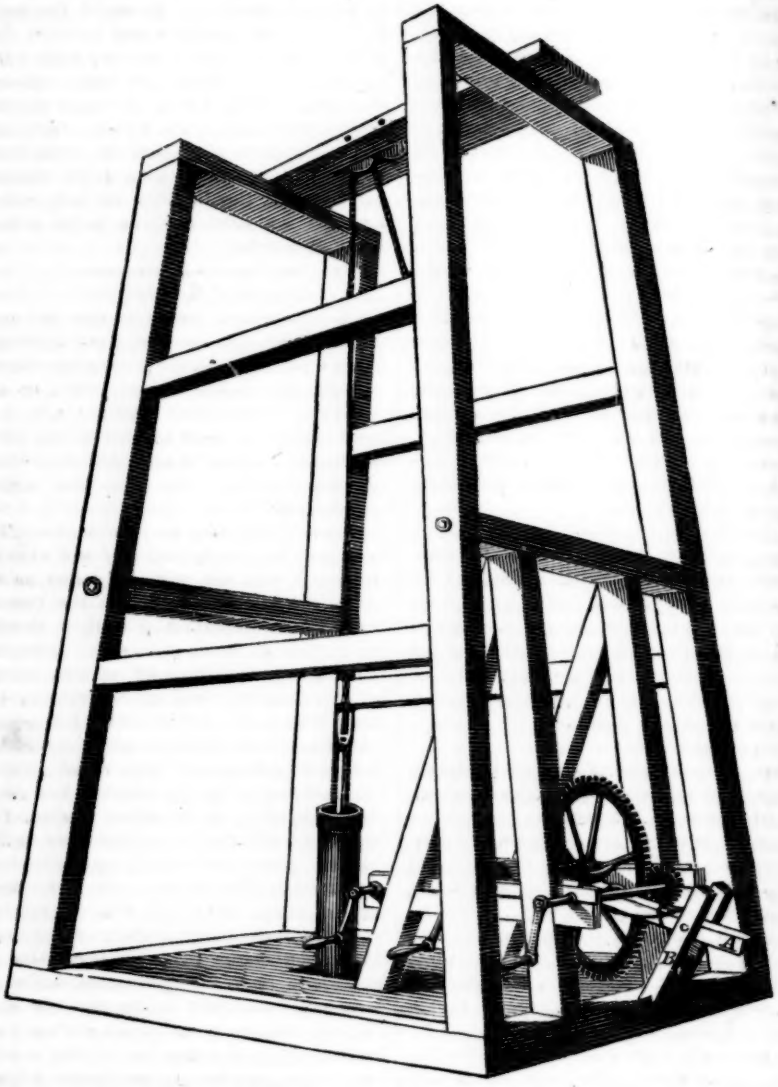
By constructing lateral branch railways, the main line will be united with the Delaware and Hudson Canal and Rail-Road, the proposed Delaware and Philadelphia Canals, and, in the valley of the Susquehanna River, with the proposed slack-water of the Otsego branch; also with the Chenango, Chemung, and Pennsylvania North Branch Canal, and the Ithaca Rail-Road. It would interlock with the contemplated canal between the Genesee and Alleghany Rivers; unite with the outlet of the Chatauque lake; connect with the French Creek feeder, and the Pennsylvania and Ohio Canal; pass the Illinois River at the head of steam-boat navigation; connect with Lake Michigan Canal, at the distance of sixty miles from the last point, and end in the valley of the Mississipi."

AMERICAN COTTON.

"The subject of cotton is one that not only interests the speculator, but directly, and in a great degree, the planter, merchant, capitalist, and holder of real estate, in all sections of the southern country; and in a lesser degree, in other sections of the United States. It may be said without fear of contradiction, that cotton is the great staple of the world, giving employment to more force and capital than all else besides. To those who are so immediately and closely connected with the value of cotton, as all are in the southern section of the United States, it is important that they should know, with as much certainty as is practicable, the probabilities of present prices being maintained, or of an *improvement* on those prices. It is important, because it affects the value of all kinds of property, as well as increases or lessens the circulating medium. On the value of this great staple, depends, in no small degree, the ability or inability of all communities in the southern states, of complying with their contracts; it affects the credit, the standing, of every individual, and extends its influence into every branch of business. The merchant, the capitalist, the holder of real estate, and the speculator, taking a prospective view and fearing that this article may decline in value, become more or less affected, and enterprize receives a serious check. On the contrary, if after having taken this prospective view, and examined carefully every thing connected with the

great staple of the south and of the world, they shall come to the conclusion that it *will advance in value*, confidence is maintained—all become participants in the advantages, and we move along happily together. It seems to me if we ever had reason thus to move along through life, it is at the present moment. Every thing is in favour of a great change for the better in the affairs of the commercial world, and especially in the affairs of those sections of the country that are immediately connected with the value of cotton."—(Augusta Chronicle.)

DISBROW'S APPARATUS TO BORE THE EARTH FOR WATER.



We recollect passing through a town in the country, some years since, and upon the side of the hills, in the neighbourhood of almost every farm-house, there lay huge piles of rocks and gravel, which the unlucky farmers had been induced to dig out of the earth, relying upon the supernatural power of a fat, well-dressed gentleman, who had condescended to remain in the neighbourhood for a very few days to detect, by means of a rod, the precise place where good water could be found. Notwithstanding a feeling in which we naturally indulge, that those who will be fools, deserve to suffer, we could not avoid a strong disposition to behold the rod used in a very different manner, in connexion with the worthless empirick; and we do not know that we should have felt sufficient charity for the farmers themselves, to have exempted them from the same application, had we not heard such impressive stories of disappointment and unavailing expense. The heavy fees which this travelling impostor exacted from those whom he pretended to benefit, would alone have been a serious draft upon the monied resources of the village; but, in addition to those, the great expense of excavating the soil, which a surprizing number had incurred, and a majority of them without the least success, was enough to make it a bad year for those who were weak enough to believe in the virtues of the divining rod.

A method of obtaining good water, has, within four months, been introduced into this city, under the sanction of previous success in many different parts of the United States, almost without exception. We refer to the invention of Mr. Levi Disbrow, now under the superintendence, in this city, of Mr. J. West.

On the new land, (formerly called the Mill Pond,) this machine was tested by a place which had baffled all former attempts, and resulted, after sinking cast iron tubes to the depth of fifty-two feet, in obtaining fifteen gallons of good water, per minute, within twenty feet of the surface.

Another experiment took place in Merrimack street, for Mr. Ezra Trull, on land of the same nature; and the tubes sunk forty feet, and yielded ten gallons of the best water, per minute, and within ten feet of the surface.

Another in Sea street, upon salt water flats, covered with earth, the tubes were sunk one hundred and five feet, yielded pure soft water, within fifteen feet of the surface, and in quantity, at least thirty gallons per minute. The water will rise, in the latter, to within four feet of the surface. This well is situated near the end of the free bridge, and cost about five hundred dollars.

Another instance, in this city, of the entire success of this invention, is upon land of Cyrus Alger, Esq. at South Boston, where the water rises plentifully, and of excellent quality, to the surface. The land, in this case, was also artificial.

Two more tubes are now sinking on the Mill Pond land, which promise equal success.

But the performances in other parts of our country, are much more surprizing, and unquestionable criterions of the efficacy of this invention, than the familiar ones which we have enumerated. The earth has been bored, by Mr. Disbrow, to the depth of four hundred and fifty feet; and rock, to the depth of six hundred seventeen feet, and with comparatively light expense. In New-York, after boring fifty feet through sand, and four hundred through rock, pure soft water was obtained, in quantity, thirty gallons per minute. And in Watertown, New-York, a well has been bored, by this machinery, one hundred and seventy feet deep, which yields thirty gallons of water per minute, fifteen feet above the surface of the earth.

The annexed drawing gives a view of the machinery and apparatus, used in boring for water. The frame work is usually boarded over, affording shelter to the workmen. The drawing gives a view of the apparatus for raising the augurs and drills, with sufficient accuracy for the understanding of the reader, with the exception of the mode of using the drills; this is effected in a very simple, and yet, efficient manner; an eccentrick cam, or bent lever is attached to the shaft of the outer wheel which operates on the lever A, and which is supported in the crutch B. From this lever a line passes over a pulley in the cross piece at the top of the frame work, and is brought down and attached to the shank of the augur, in the lower end of which the drill is affixed; now every turn of the crank brings this cam in contact with the lever A, depressing the inner arm, and thus raising the drill about one foot, which, in the passing of the cam, is freed, and thus falls by its own gravity. The cast iron tubes are in lengths of about 6 feet, and secured together by wrought iron bands, and, after being made water tight with small iron wedges, are forced into the hole

bored with the augurs, by levers passing over the upper end; thus shutting out all the impure water from the upper strata.

We look upon this invention, or improvement of Mr. Disbrow, as a very useful and important one; for, until this was brought into use, there were many sections of our city, where it was impossible to get good water, the upper strata being so completely saturated with impure and subtile gases, which penetrated through every kind of curb and boxing which had heretofore been used, while by using these tubes of iron, the water is as pure as when first issuing from the spring. And if we are correctly informed, the expense is less than heretofore incurred in the usual way of digging and stoning up the well.

From the representations of the variety, and at the same time of the simplicity of the instruments used in Mr. Disbrow's method of finding fresh water springs, it is hoped that our countrymen will either have the liberality to adopt his method generally, or the ingenuity to improve upon it. We believe the several figures will need no further explanation than that which accompanies them.

Fig. 1,

Represents the augur used for boring through the strata of common earth, or clay. This tool is not suitable for sand, or very coarse soil, as it is necessary there should be some adhesion, or it would not bring up the portion of substance it had passed through.

Fig. 2,

Is the tool used in sand, or very light gravelly soil, and is provided with a valve which, closing, brings up all that has passed through it.

Fig. 3,

Is used for hard clay, or clay and gravel mixed.

It is, perhaps, proper here to observe, that these tools are all of the same diameter with the inner diameter of the iron tube.

Fig. 4,

Is a pair of nippers, or tongs, for bringing up loose stones, or other detached substances. In using them the ring is shoved up and the arms expanded the full size of the bore, and when they have seized upon the object to be removed, and the shaft drawn upward, the ring slips down, and thus secures whatever is within them.

Fig. 5,

Gives a view of the iron tube as obstructed in its descent by a projecting ledge of rock, and, to remove which, a drill, (having a bow spring attached, for the purpose of giving it an effectual direction,) is made secure to the end of the shaft, and the operation of cutting away the rock commences by means of the cam wheel; after which the tube is again forced forward.

Fig. 6,

Is a drill for boring through rocks; this must be made with great care, in all its parts, for should it break in the hole, it would, in all probability, suspend the whole operation.

Fig. 7.

This tool is called the bell; it is used to bring up a broken shaft. The wide part fits accurately to the tube, and, in descending, inducts the broken end of the shaft into an aperture fitted to receive it, above which a clevis is placed, and as the bell is drawn upward the clevis presses the shaft against a steel barb, which is between the clevis and the top of the bell, by which means the shaft is secured, and the whole drawn up together.

Fig. 8,

Is a wrench, which is secured to the shaft by means of a screw, and serves as a handle to turn the shaft.

We hope, after Mr. Disbrow's invention is made known through the country, that those who are so situated that they find it necessary to resort to wells, will be induced to try the efficacy of a machine which operates upon simple and well known principles; and that the unworthy superstition, which we have referred to, will cease to obtain credence among a people who have all the opportunities for knowledge, and among whom, therefore, ignorance is a disgrace. To our citizens, this invention seems to have some claims to attention, in preference to other schemes which have been promulgated in the long agitated question, "How shall we best supply ourselves with water?" We do not undertake to pronounce Mr. Disbrow's method of supplying water, the best; but we earnestly invite the attention of our readers to this subject, and shall be glad to publish their speculations, without partiality.

COMMUNICATION.] [FOR THE MAGAZINE.

COOKING APPARATUS.

In the recent report made to the legislature from Wm. Austin, Esq. the warden of the Massachusetts State Prison, it is stated, that the cookery has a cistern to contain 4000 gallons of water, supplied from the roof of the new prison, and a reservoir to contain 2000 gallons, supplied by a forcing pump. In the centre of the building is a steam boiler from the Sing Sing prison, a highly useful and convenient machine, which cooks for the convicts, at a reduction in the expense of the fuel used for that purpose, of one dollar per day. The fuel used, says the warden, is Lehigh coal. Opposite the boiler is the ordinary furnace, only used while cleaning the boiler, or in case of accident. I understand that the whole establishment is very complete, and reflects great credit upon those who were its projectors.

My principal object of notice at this time, is the *steam boiler;* and this, I believe, is a very valuable improvement in the cooking department of all large establishments, such as state prisons, penitentiaries, houses of industry, &c.; and I do hereby invite the attention of our respectable board of directors of the house of industry at South Boston, to examine this engine. Its simplicity of construction, the low price at which it comes, (only $120,) and above all, its great saving in the consumption of fuel, all recommend it to their favourable regard; and as economy with them, in every department, is so great a *desideratum*, it cannot fail to receive this notice from them. HOWARD.

PREMIUMS FOR APPRENTICES.

The sum of ten dollars has been received as a *nucleus* to a fund for the awarding of premiums for the best specimens of mechanick workmanship in the various branches.

We believe there are about thirty-two different professions in the mechanick arts. All of them, to be sure, are not of a nature to admit of articles being wrought and presented for a premium—but there are a great number which may be, and when the many moral and other considerations are taken into view, connected with this important subject, we should hope that it might receive such attention and encouragement as its merits justly entitle it to. Such leading articles, say to the number of three in each branch of business, might be selected, having regard to simplicity of style, economy and convenience, with such specifications of a general character, as would be sufficient to enable the young workman to understand and set about and complete his job.

The sum of ten dollars to begin with may appear small, but the circumstance of *the dollar* which was left at one of our banks, some years ago, by a sailor, on receiving payment of his check for his wages, as a *foundation* for a seamen's church, and the now final erection of the capacious and handsome brick edifice on Purchase street, from a fund of which that dollar was the commencement, must not be forgotten.

COMMUNICATION.] [FOR THE MAGAZINE.

APPRENTICE'S REMEMBRANCER.

Wherewithal shall a young man cleanse his way?
By taking heed thereto, according to thy word.
Ps. CXIX, 9.

It is time that, in a community like ours, a few thoughts should be devoted to the moral welfare of the large and increasing class of apprentices. The situation, indeed, of any youth who is withdrawn from the protection of the parental roof, and separated from the scenes which have been familiar to infancy and boyhood, is peculiarly interesting. His own feelings and dangers; the views of friends respecting him; the success of his efforts in promoting the benefit of his employer—that new friend, patron, guardian, and as it were, FATHER, to whose discretion and kindness he is now surrendered; all these, in the case of the apprentice, even separate from

the general welfare of the community, which is the aggregate of the happiness and usefulness of its members respectively, demand consideration.

As to feelings—with him, childhood and childishness are now at an end; and he is to enter on the preparation for manly occupations in life. He feels, occasionally, his strength, but hardly knows his own weakness. He regrets, occasionally, the scenes of earlier life, but hardly dares trust himself to dwell on them. He may find attention from those by whom he is surrounded; but it is not often the ever-wakeful, affectionate, all-pervading care of a *mother*. And yet, he must stifle or suspend the exercise of memory, lest it unfit him for the business before him—the demands of imperious duty.

As to his dangers—he is in hazard of losing the favourable impressions made on his early character. By intercourse with those, who regard little the sensibilities of the youthful bosom, or glory in their own emancipation from them, he is in hazard of losing his own moral tenderness; and, unhappily, there is indeed, too much remaining of rude, unfeeling, or corrupting influence in the work-shop, or places of business of multitudes of our laborious citizens.

As to friends—has the apprentice parents? They are, or ought to be, "feelingly alive" to his welfare. And if so, every important variation of manner, circumstance or conduct, observable in him, is the subject of anxious notice. In his success, it may be that many affectionate hearts are interested, from more than one cause. He may be, and often is, the sole earthly hope of a widowed mother, and fatherless sister; and should he not be all that their hopes paint, and their necessities crave—the result will be fatal to their peace.

I omit a further pursuit of these considerations, to turn, for a moment, to the just requirements of the new mode of life, and employment, on which the apprentice is entered. These demand fidelity to the interests of his employer—a rigid, yet affectionate fidelity; for the interests of his new protector are to be regarded as his own. And what are the just expectations of that protector? Can any thing less than a strict and pure morality answer them? By no means. The master, indeed, has his duties to fulfil, as the apprentice has duties peculiar to himself. The obligations are mutual, and demand mutual faithfulness.

We perceive then that, separately from considerations of general obligation on the whole community, there are some interesting peculiarities in the condition of an apprentice. What shall meet the necessities of the case, and prove a substitute for the parents eye, and counsel, and affectionate, watchful care? What shall guard from moral peril, the untried, inexperienced youth, and direct him safely? How shall he rectify the evils of his own heart, and find and keep the path of life? I reply, by recommending to his intimate acquaintance, and daily, humble consultation, that best guide, companion, teacher, and friend—the BIBLE. MENTOR.

CHOICE OF OCCUPATION.

"It is a very common errour with parents, in determining upon the future occupations of their children, to fix upon a profession, or some sedentary employment, for those of a weakly or delicate constitution; while to the robust and vigorous, is assigned a more active and laborious occupation, demanding considerable bodily exertion, and repeated exposure to the open air. As a general rule, the very opposite of this course should be pursued: the robust being the best able to bear up against the pernicious effects of that confinement and inactivity, to which the enfeebled constitution will very speedily fall a prey; while the latter will be materially benefited by the very exertion and exposure to which it is supposed to be unadapted.

When we examine the individuals who compose the various trades and occupations, and find certain classes to present, very commonly, a pale, meagre, and sickly aspect, while others are replete with health, vigour, and strength, we are not to suppose that because the pursuits of the one demand but little, and those of the other considerable bodily strength, the first are best adapted to the weakly, and the latter to the strong: we are rather to ascribe this very difference in their appearance, to the influence their several occupations exert upon the health of the system.

Let the most healthy and vigorous individual exchange his laborious occupation in the open air, for one which requires confinement within doors, and but little exercise, and his florid complexion, well developed muscles, and uninterrupted health, will very speedily give place to paleness, more or less emaciation, and debility, and occasionally to actual disease of the stomach or lungs. On the other hand, the reverse effects will be

produced, by the sedentary exchanging, before it is too late, their confinement and inactivity, for some active employment in the open air. These are important considerations, an attention to which, in the choice of a profession, would be the means of saving not a little suffering,—in many instances, of prolonging life."—(Journal of Health.)

COMMUNICATION.] [FOR THE MAGAZINE.]

Translated from the Paris Moniteur of 20th Dec. 1829. *"Society for the Encouragement of National Industry. General Meeting of the 2d Term.*

This meeting took place last evening in the Hall of the Society, No. 42 Rue du Lac, for the purpose of declaring the prizes of this year, and to propose subjects for the next.

A premium of 1000 francs was adjudged to Mr. Coffin, mechanick, of New-York,* (United States,) for the construction of a machine for shaving the fur from skins for hatters use.

With this machine, of which the principle is at once simple and ingenious, four persons can do, in ten hours, the work which, in the ordinary process, requires twenty-five; and the cost, which in the latter case would be 28f. 60c. is reduced to 5f. 7c."

The above mentioned machine was patented at Washington, Nov. 10th, 1828. We have seen it in operation in this city. It is far superiour to any thing of the kind before in use; it is not liable to get out of order. We have seen a person, who, turning it with the foot, and guiding, occasionally, the skin with the hand, has cut a pound of muskrat fur in an hour; it is equally applicable to beaver skins, or any others of sufficient substance. And we believe that twenty of these machines, moved by a small steam engine, and fed by boys or girls, would cut all the fur used in Great Britain by the hatters, and at a very trifling expense; and we think the New-York fur companies might advantageously change their mode of selling, by previously separating the fur from the skin and disposing of all their produce by the pound of fur, classifying it according to quality.

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* This should be Boston.

PATENTS.

It may aid those who have business at the Patent Office, to be apprized of the following, which is replete with valuable information to them; but contains, also, something of interest to the general reader. Although of not a very recent date, we are not aware of any material alteration. If there should be any, we shall be informed of it, and will make the same known to our readers.

"Having the honour of directing or superintending the important duties of issuing patents for arts and inventions, I have thought it a duty to my fellow-citizens to publish a few lines of information, to facilitate the mode of acquiring patents, by which many may be enabled to dispense with long journeys to the seat of government, or troubling their friends with a tedious correspondence.

Viewing with astonishment the inventions of my countrymen, I cannot contemplate them without being impressed with the idea that no nation on earth surpasses them in genius. Even the unlettered inhabitants of the forest have perfected inventions that would have done honour to Archimides; and I reproach myself for not having published long ago, a few directions how to proceed in securing the advantages of the efforts of their talents.

Before an application be made for a patent, I would advise the inventor to examine well the dictionaries of the arts and sciences, the 'Repertory of the Arts,' and other publications that treat of the mechanick arts, to endeavour to ascertain if the invention be new; also to make enquiry, of scientifick characters, whether or not the invention or discovery be practicable. These previous enquiries will sometimes prevent great trouble, and save the expense of much time, labour, and money; for a patent does not confer rights where just claims do not exist; and as there is at present no discretionary power to refuse a patent,* even where no just claim exists, it may be proper to caution the purchaser of patent rights against the supposition that the invention patented, is always valuable, or new, or that it interferes with no previous patent. The respectable names of the president, the secretary of state, and attorney general, are requisite to give validity to a patent; but ought never to be considered as an evidence of the originality or utility of the invention. The issuing of patents is grounded, not only on a desire to promote the progress of useful arts, but also to prevent the loss of valuable se-

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* Except in the cases of interfering claims, till such claims have been settled by reference, according to the 9th section of the law, vol. 2, Laws of the United States.

crets; for many have been buried with the inventors, previous to the organization of this system of protection for the property of talent, mind and genius. Formerly the arcana of any profession were withheld from the tyro; his initiation was gradual and secret, and the caution with which inventors worked, to prevent the infringement of unprotected rights, confined many important inventions to limits too narrow to materially benefit the inventors, or the world; at present the law grants a monopoly to the inventor for a limited time, provided the art, invention, discovery, or machine, be truly explained, deposited and recorded, for the benefit of mankind, when the time limited has expired; and the patent is not only an evidence that the inventor has formally confided his secret to the publick, but also a declaration of the protection of the right from infringement; nevertheless, of the infringement of the right, by others, a jury of the country is only competent to decide.

As it can be mathematically demonstrated that no human invention can produce a machine capable of undiminished power, or power regenerating itself, and forming what is called a perpetual motion—an OPERATIVE MODEL will be demanded for every such attempt, before a patent can be granted; otherwise no proof can be given of its being what its name designates, and for which a patent is demanded. It is hoped that this will prevent many ingenious, but unlearned men, from attempting what the scientifick know to be impossible. Some set out by searching, through levers and large wheels, to increase power; forgetting that this is to diminish velocity—then they multiply and diminish the power to give velocity; this brings them to the point whence they set out—thus it is considered as an axiom in mechanicks, that to increase power is to diminish velocity, motion or action, and vice versa. They must also consider that man in all his operations, works against gravity and friction. A perpetual MOTION, is, therefore, only considered as a perpetual NOTION; and ought never to be attempted till the sun rise in the west!

The general law concerning the issuing of patents will be found in the second volume of the laws of the United States, page 200.* This law provides for citizens only; but a subsequent law† (vol. 5, page 88) provides also for applicants who have resided two years or upwards in the United States, and who are not citizens.

In applying for a patent, it is necessary to attend to every legal form; for, in consequence of inattention to forms* only, some of the patents issued formerly, have, in courts of law, been declared to be null and void.

MODE OF APPLICATION.

Every inventor,† before he presents his petition to the secretary of state, signifying his desire of obtaining a patent, shall pay into the treasury of the United States thirty dollars,‡ for which he will be furnished with duplicate receipts, one of which he shall deliver to the secretary of state, when he presents his petition; and the money thus paid, shall be in full for the sundry services to be performed in the office of the secretary of state consequent to such petition. This petition must be addressed to the secretary of state, and may be in the following, or in a similar style:

To —— ——, Secretary of State of the United States:

The petition of A. B. of ——, in the county of ——, and state of ——, respectfully represents:—

That your petitioner has invented a new and useful improvement ["or § art, machine, manufacture, or composition of matter, or any new and useful improvement in any art, machine, manufacture, or composition of matter,] *in —— ——, not known or used before the application," the advantages of which he is desirous of securing to himself and his legal representatives, he therefore prays that letters patent of the United States may be issued, granting unto your petitioner, his heirs, administrators or assigns, the full and exclusive right of making, constructing, using, and vending to others to be used, his said improvement,* (art, invention, machine, manufacture or composition of matter, etc.) *agreeably to the acts of Congress in such case made and provided; your petitioner having paid thirty dollars into the treasury of the United States, and complied with other provisions of the said acts.* A. B.

The *specification* or description of the machine, art, discovery, or invention, must be given in clear and specifick terms, designating it from all other inventions, and

* Edition 1793—Page 348, edition 1815.
† Old ed. but vol. 3, new edition.

* Oliver Evan's was among the number.
† See Laws U. S. vol. 2, ch. xi. § 11, p. 205.
‡ Notes of the bank of the United States.
§ 1st section of the above, page 200.

describing the whole in such a manner, as to comprehend not only the form and construction, (if a machine,) but also the mode of using the same; and if it be only an improvement on a certain machine already invented by the applicant or any other, it ought to be so mentioned or described; and as this specification, description or schedule, enters into, and forms part of the patent, it must be without any references to a model or drawing, and must be signed by the applicant or applicants, before two witnesses. Let it also be as concise as the nature of the case will admit. If they exceed one sheet, to facilitate the duties of office, and prevent delay, it is hoped the applicant will also send a fair copy of his specification on parchment, 12 by 15 inches, leaving a margin of an inch round, but 1½ inch where it is to be stitched.

(Concluded in our next.)

LIST OF AMERICAN PATENTS,

WITH THEIR SPECIFICATIONS, FOR OCTOBER.

[In future, the specifications will accompany the articles patented, as appears in the following; and which are published every month, in that respectable periodical, the Journal of Institute, printed in Philadelphia, from which we also selected the list of patents, as published in our first number.]

1. For a Machine for Cleaning the Dirt, &c. from Seed Cotton; James Gilliam, Carrol county, Tennessee, October 10.

A hollow drum, of six feet in length, and 20 inches in diameter, is made to revolve, in the manner of a bolting screen, but with its axis horizontal. Its periphery is formed by slats of wood, extending from end to end, and having a space of about half an inch between them. This drum is contained within a trough, or box, and rests upon friction rollers, upon which it revolves, as it is without gudgeons. A shaft extends through the centre of the drum, and is supported upon gudgeons outside of its heads; four boards are affixed by their edges to the shaft, and extend the whole length of the inside of the drum, forming wings, or leaves, standing at right angles to each other; upon the edges of these wings are placed, obliquely, flat pieces, to serve as conveyors, causing the seed cotton to pass from one end of the drum to the other. The shaft, with its wings, revolves much more rapidly than the drum. The cotton is put into a hopper, and in passing from one end of the drum to the other, is cleaned.

The claim is to the "whole of the above described machine."

2. For an improvement in the Manufacturing of Gentlemen's Stocks; G. R. Lillibridge, New-York, October 10.

The foundation, or stiffening part of this stock, formed of two pieces, joined together lengthwise, say of doubled buckram. They are so joined that they move on each other, as on a hinge, and are hence called "hinge stocks." When thus formed, they are to be covered and lined in the usual way. The buckram may be rendered water-proof, by shellack varnish. The claim is to "the composition, and manner of forming the hinge, by which the two component parts of the foundation of the stock are united together, by which the same is rendered sufficiently pliable, without the possibility of becoming displaced by ordinary wear."

3. For an improvement in making Combs; Eli Sperry, New-Haven, Connecticut, October 10.

A quilled back comb is to be made of wood, the grain running with the teeth of the comb; a tube of metal, the bore of which exactly fits the back of the comb, is then drawn over it, and cemented or not, as may be thought best; there must, of course, be an opening along the tube to allow for the thickness of the teeth of the comb. The claim is to "the hollow wire tube."

On the 14th of April, a patent was obtained by Nathaniel Bushnell, of Connecticut, for manufacturing quill backed combs of wood, by making the back and teeth in separate parts, with the grain in each running longitudinally; the part forming the teeth being let into a groove in the back; this appears to us preferable to the plan now proposed.

There is not any drawing accompanying this specification; the patentee may say that it can be perfectly well understood without one; but the law says: "and shall accompany the whole with drawings and written references, whenever the nature of the case admits of drawings."

4. For an improvement in River Dams, for the easy passage up and down of fish, and of vessels; Patrick M'Grath, Philadelphia, Pennsylvania, October 10.

If we understand the description of this improved mode of forming dams, it consists in making the dam on the descending side, in the form of a plane, but little inclined to the horizon, so that the water in passing down shall run with but little velocity. The claim is to "an easier communication between rivers and dams, for fish, vessels, &c."

5. For an improvement in the Application of Power to Machinery; Robert Mitchell, Cynthiana, Harrison county, Kentucky, October 10.

This patent is for one of those outrages upon the A, B, C of mechanicks, which might astonish us were they not so frequently perpetrated. The screw of Archimedes is to be made to elevate iron balls of 200 lbs. each, which are to fall upon a bucket wheel near its top, and be delivered at the bottom into a trough, down which they are to run into the "Elevator." "The power of one horse will run the elevator with twelve balls weighing 2400 lbs.; this weight applied on the side of a wheel 30, or any other convenient number of feet in diameter, may be applied to the running of any kind of machinery," says the patentee, and no doubt he is correct, provided his machinery does not require more than the power of half a horse to turn it.

If power is to be thus gained, why fatigue and feed the horse? a little of this swindled power may as well be applied to the turning of the elevator, and the circulating medium of iron be thus rendered perpetually current.

6. For a machine called "the Queen Washer," for Washing of Clothes and clothing, and scouring the same; Pinkham Mosher, Milton, Saratoga county, New-York, October 10.

This *royal* washing machine bears a strong resemblance to some of its cotemporaries, as other royal personages are found strongly to resemble the less elevated of their species. There is a circular segment furnished with rollers; upon these rollers the clothes are to be placed, when they are to be acted upon by rollers placed upon a swing frame, suited to the lower segment.

7. For a Machine for Sawing Shingles; Richard M. Omber, Galway, Saratoga county, New-York, October 10.

Thirty-five well filled pages of foolscap are occupied with the description of this machine, although the instrument itself is not very complex.

Numerous patents have been obtained for shingle machines, some of which strongly resemble the present, and are in successful operation. A circular saw is driven by a whorl and band; the block from which the shingles are to be sawed is fixed by dogs, or holdfasts; the carriage upon which it is secured is made to traverse backwards and forwards, and a cant is given to the block, to regulate the thick and thin end. The claim is to "the application of springs and cords, in the manner described, to produce the feeding of the shingle block, up to the saw, and the re-adjustment of the carriage after a shingle is sawed,"—the peculiar mode in which the guages are fed which regulate the thickness and shape of the shingles,—the mode of drawing back the block piece, &c. of the carriage after the shingle block is sawed up,—the peculiar construction of the cog wheel by which the carriage is impelled forward until a shingle is sawed, and then permitted to return by the vacancy on said cog wheels.

We have not thought it necessary to attempt a description of these respective parts, because they do not appear to us to possess much either of novelty or of merit in the combination.

8. For an improvement in the Rubbing Down and Polishing Combs by "twin buffs," Lewis B. Prindle, and David Curtis, Fairfield, Connecticut, October 10.

Instead of using one buff, in the ordinary way, the patentees cause two circular buffs to revolve in reverse directions, with their faces in contact; these buffs are covered with some spongy material, and are charged with pulverized English brick, for rubbing down, and with rotten stone for polishing, or with any substances possessing similar properties. Between these buffs, the backs of the combs to be rubbed down, or polished, are to be held.

It is unnecessary to describe the mode of driving the mandrels upon which the buffs are placed, as any workman can effect this. The novelty for which the patent is taken, is, manifestly, the twin buffs.

9. For an improvement in Bilgeways, called "Frame Bilgeways," for the purpose of drawing out of the water, and re-launching, ships and other vessels; John Thomas, New-York, October 10.

The frame bilgeways consist of two longitudinal timbers, with nine cross timbers of solid oak crossing them at right angles, and securely bolted to them; five of these nine pieces project beyond the longitudinal pieces. The patentee says, "it may be proper for me to describe the common bilgeway, which is as follows: the common bilgeways are large square pieces of timber, extending nearly the length of the vessels to which they are applied, one of which timbers is placed on each side underneath the bottom of the vessel intended to be launched, or hauled up, leaving the fore and after part of the vessel unsupported."

"The principle, or character, which distinguishes the improvements I have made in the construction of the frame bilgeways for drawing out of the water for repairs and re-launching ships and other vessels, consists in this: the cross timbers uniting the lengthway timbers at right angles do thereby compose a frame on which the keel and the bilge of the vessel are always supported, and which constitutes the Frame Bilgeway. On the projecting parts of the long cross timbers will be the support of the sides, and the upper parts of the vessels."

10. For an Eight Barrelled Percussion Gun; Samuel L. Faries, Middletown, Butler county, Ohio, October 10.

We have described several guns for which patents have been obtained, which were provided with a revolving breech, containing four or more chambers to be loaded at one time, and successively brought to coincide with the main barrel, and have spoken of the difficulties attending their employment. The present patentee is more bold than his predecessors, as he proposes to adapt a similar contrivance, not to rifles merely, but also to cannon. He has a revolving breech consisting of eight chambers, united together so as to form radii, each being furnished with its touch hole. This radiating breech turns, with play on a centre pin, so that each chamber may in succession be brought to coincide with the main barrel, against which it is to be pressed by a screw bearing against the end of its opposite chamber. A percussion lock is to fire the piece.

Should a piece of ordinance of this description be manufactured, we should stand aloof at the time of proving it; for although the cheeks between which the breech is to revolve, and also the end in which the screw works, are to be cast solid with the body of the gun, we fear that those behind would be in as much danger from the breech as those before from the ball. A cannon divided transversely, and held together by a screw behind, even supposing no actual fracture to take place, would open the joint every time it was fired, from the power of the recoil, and the vibratory motion experienced by every part of it. The percussion lock for cannon is not that simple thing which answers for small arms; upon this we might offer many remarks, but must defer them for a time. The rifle which Mr. Faries has represented in his drawing, although less objectionable than the great guns, is not, we apprehend, altogether free from the difficulties which have been encountered, but not overcome by its predecessors.

11. For a mode of Raising Vessels out of Water, called the "Screw Dock;" Elisha Turner, Rochester, New-York, October 10.

In the construction of this dock, as represented in the drawing, a slip, or pier, is formed by driving rows of piles; and these inner rows are to

be framed and braced to other rows of piles driven at a suitable distance outside of the former. Upon these a second frame is to be constructed of a height sufficient for the raising of a vessel.—Through the strong upper timbers of this frame, screws are passed, the heads of which rest upon the frame, their shanks extending down and working into female screws firmly fixed in the tops of vertical sliding pieces. To the lower ends of these sliding pieces are framed bearers, extending from one side of the dock to the other, the beams thus attached to opposite slides, serve, unitedly as a cradle to sustain the vessel, which is to be floated in over them, and raised by the screws.

To us, this screw dock appears to be in some points inferiour to those formerly patented, particularly in the fixing of the nuts in the tops of the slides, where it will be difficult to secure them so as to sustain the enormous weight which they are intended to bear. Perhaps the patentee may have some superiour mode of doing this, but if so, he has not explained it. The drawing gives no aid for understanding the details, as it is very indifferently executed. The inventor says, "I claim as my invention and improvement the above described new method of placing and securing the screws employed for raising vessels by means of two frames placed one on each pier, and by means of posts and slides, prepared and placed in the manner above described, so that the screws may be wrought wholly out of water, and be turned by machinery placed upon the frames erected upon the piers."

"The inconveniences experienced from working screws under water are many and great, and by this improvement are avoided, and the screws made to work much more securely, and much easier; and the labourers, and the machinery used to turn the screws, are placed in a much more convenient situation while employed in raising the vessel."

TO BE CONTINUED.

NUMBER OF PATENTS GRANTED FROM THE YEAR 1790 TO 1828.

By the following Tables, which have been compiled from the Official Statements of the Patent Office, it appears that there were issued from the year 1790, to 1814 inclusive, 2227 Patents; and from the year 1815, to 1828 inclusive, 3289, making together, for the whole 39 years, 5516 grants.—(American Almanack, &c.)

Years	No.	Years	No.	Years	No.	Years	No.	Years	No.	Years	No.	Years	No.	Years	No.	in1814
																214
1790	2	1793	20	1796	45	1799	44	1802	72	1805	55	1808	155	1811	219	
1791	35	1794	24	1797	51	1800	25	1803	91	1806	62	1809	204	1812	260	Total.
1792	10	1795	11	1798	26	1801	46	1804	84	1807	102	1810	218	1813	152	2227

States.	1815	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	1826	1827	1828	Total
Maine . . .	1	1	1	2	—	6	3	9	6	7	17	29	16	12	110
Mass. . . .	21	32	31	37	20	25	19	22	23	23	26	33	39	51	402
New-Hamp.	1	6	10	11	5	3	—	2	4	2	4	3	3	5	59
R. Island .	4	1	1	12	2	2	5	5	1	7	10	8	7	10	75
Connecticut	20	17	7	17	8	17	7	17	11	17	12	14	19	28	211
Vermont . .	3	4	5	1	9	4	4	8	5	5	7	3	11	10	79
New-York .	57	53	39	70	36	41	74	74	60	82	112	116	109	175	1098
New-Jersey	8	11	1	6	2	2	7	6	9	15	10	6	7	6	96
Pennsylva.	23	30	19	33	23	8	13	27	20	25	38	35	37	54	385
Delaware .	—	1	—	4	1	—	—	—	1	2	1	1	2	2	15
Maryland .	9	13	19	15	12	13	8	8	3	8	11	12	17	20	168
Virginia . .	8	9	9	15	11	6	10	12	10	9	15	13	18	19	164
N. Carolina	1	3	1	—	3	1	2	1	2	1	3	12	25	3	58
S. Carolina	—	1	—	—	6	2	2	4	2	2	3	5	3	10	40
Georgia . .	—	—	—	2	1	1	1	—	—	4	—	—	—	7	16
Ohio	—	6	1	5	1	6	6	1	5	11	10	10	16	30	108
Kentucky .	1	7	1	3	—	3	—	1	—	4	5	3	1	11	40
Tennessee .	—	2	1	2	2	3	—	1	1	2	2	1	5	7	29
Illinois . . .	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Indiana . .	—	—	—	1	2	2	—	—	1	1	4	1	3	6	21
Alabama . .	—	—	—	—	—	—	1	1	1	2	1	—	—	—	6
Mississippi .	—	—	—	—	—	—	—	—	—	1	1	1	—	—	3
Louisiana .	1	—	1	2	—	—	2	1	2	2	1	1	—	—	13
Missouri . .	—	—	—	—	—	—	—	1	2	—	1	—	2	—	6
District Col.	2	8	4	5	3	1	4	3	2	2	7	5	4	1	51
Uncertain .	5	4	2	5	2	—	3	—	—	—	—	—	—	—	21
England . .	—	—	—	—	—	1	—	—	1	2	1	4	3	3	15

COMMUNICATION.] [FOR THE JOURNAL.

NATIONAL WORKS.

There is, unfortunately, abroad, amongst a numerous and respectable class of politicians, an impression that Internal Improvements, by canals, rail-ways, and great roads, are acts, not authorized by the federal constitution.

Let us consider this subject: it appears to be worthy of serious consideration, under various aspects; and if it should be found, not to be repugnant to the spirit, or the letter of the constitution, it will be admitted that some great and decided advantages may be derived from this act of sovereignty.

In the first place, the difficulty of disposing of that surplus revenue, with which we shall soon be burdened, (an event not more anomalous in the annals of national finance, than it is certain,) will find here a remedy, both safe, and eminently useful in other respects.

We cannot imagine, that it will be the policy of the government, to reduce the duties, so suddenly, as to meet the emergency; this would be, not only contrary to the usage of all governments, which have any regard for stability, but contrary to good faith. Moreover, the experiment might produce an effect, quite contrary to the intention; and increase, rather than diminish the revenue. It would require a nicety of calculation, for which we have no sure data to guide us. The case is a new one, and all the elements, which would enter into its composition, are untried, and quite immeasurable from their very nature. If this were to be the remedy, and its effects were certain, there is hardly time to order, and organize its operation, before the evil will be upon us.

On the other hand, if it were resolved to employ the surplus revenue, as it might accrue, on publick works, the more or less the amount, the sooner or later the time, would be of no importance.

The first positive advantage which presents itself to my mind, in a national view, is, that this destination of an overflowing treasury, will give us the advantage, which nations in former times, were obliged to seek and secure by a dormant treasure, without the danger of this instrument of national defence. The expenditure of a constant income, unfelt by the people, would be going on in useful works, which works, however, might be suspended at a short notice, and without prejudice, and the whole amount then applied to the active operations of war, or for the purchase of territory: thus would the burdens required for war-like preparations, be comparatively light; whereas, they are commonly more onerous from the suddenness of their application, than from their real amount.

Improved means of communication, either for the arts of war, or of peace, have at all times been considered amongst the first duties of enlightened rulers. The Romans, could never have extended their conquests over the Gauls, without their military roads, which were in fact Rail-Roads without iron. The enlightened and princely merchants of Venice and Genoa, would have had but a limited market for the products of their extended foreign commerce, if they had not provided a home market, by the means of canals and roads. The first and best lessons, which modern Europe has had on great hydraulick works, were from Italy. The Hanse towns followed a similar policy, and with equal success. Egypt, in her best days, was not unmindful of the value of canals, although she had a river of remarkable extent, whose numerous mouths, were so many natural canals. China, the oldest of civilized nations, owes, perhaps, the singular advantage, (if that be one,) of self-sufficiency, to her numerous canals. She is certainly, by their means, enabled to support a population, which could not otherwise find aliment and occupation.

In addition to the advantage of having a constant income, well organized, and in full operation, always ready for an emergency; we should have the further satisfaction of seeing its product employed on works, which would necessarily increase our wealth and population, and thereby add to our physical force, and improve our moral condition. Our national force and individual comfort, would not only be increased by our positive numbers and wealth; but by the cheap and rapid means of locomotion, every assailable point of our republick, by such mighty means, would be rendered impregnable, without the cost of standing armies, numerous deposits of stores, and all the heavy and costly *materiel* of war. All these appendages, so necessary for a successful defence, and the *personel* too, of war, might be transported with such rapidity and ease, that Washington, Baltimore, and Philadelphia, might be successively defended by the same force. The rapidity of his marches, and the perfection of his *commissariat*, were amongst the principal causes of Napoleon's great conquests.

Fortified places, put the weaker nations on a more equal footing with the stronger, and have often enabled them to resist a sudden invasion, until they could prepare other means of defence, or form alliances. Thus a nation like ours, with an extended frontier, a sparse population, and a small organized force, may, with a small force, comparatively, keep a larger force in check, through the means of concentrating power, on any given point, with celerity.

I can conceive of no application of the science of political economy to national purposes, where the effect would be so surprizing and beneficial. Think of a system, whereby a nation of freemen may be employed in the useful arts, and scattered over a vast territory, to the very eve of battle, and the day after be able to return to their labours! If any system accord with our political institutions, and our habits of economy, it would seem to be one, which would accomplish so much with so little cost, as a system of rail-ways, from the seaboard to the interiour, and from other points equally interesting.

I have considered the employment of our future surplus revenue, more especially in its application to works of national defence; trusting that in this view, the right of so employing them, would be readily admitted.

I would now be allowed to enquire, whether, under the power to regulate commerce betwixt the states, and establish post-roads, it be not as competent for the federal government to make roads and rail-ways, as to improve rivers, and construct breakwaters and light-houses. I will not presume to give a positive opinion on a subject which has divided and perplexed some of our greatest statesmen; but I may be allowed to hazard a few humble queries, on a subject which I have a great desire to find conformable with a power which seems to be so essential to the general welfare of this nation. A power which must be exercised by the general government, or by no one. Shall we forego advantages which will so evidently derive from these great publick works, because they may not be designated nominally in the constitution, while they seem to be as necessary for the fulfilment of the duties enjoined on government, as to transport the provisions necessary for an army about to march, and many other acts not specified by names? Shall we deprive the nation of acknowledged advantages, civil and military, moral and physical, political and commercial, when every state, individually, will admit the benefit to be real, great and important? when no state would refuse to grant permission, if it were asked, for the construction of such works over its territory?

The first article of the eighth section of the constitution, says:—"The Congress shall have power to provide for the common defence, and general welfare of the United States."

How can Congress provide so effectually for the general welfare, as by facilitating the means of intercourse; economizing the time and labour; increasing the sum of moral and physical good of the citizens? and finally, by rendering the nation strong without, and united within?

If it should appear, that the general government have not the power to perform those ordinary acts of sovereignty, on which depend, so clearly, the general prosperity, strength and safety of the people, then will this nation present the most extraordinary anomaly ever recorded in history. A nation of freemen, boasting of the superiority of their institutions, assuming to have the best form of government on earth; and yet, possessing not the power to do that, which all acknowledge, would be eminently useful to the people and the nation; that which from time immemorial has been done by all wise governments.

It will not be said that the states and individuals have the power to perform those duties. The states have neither sufficient power, or inducement for works of great extent, unless they be wholly within their limits; and individuals can find a more immediately productive employment for their money. And neither states or individuals, would be likely to give to their plans, that character of publick good, which would result from the eye of government, which would look only to great national purposes.

F.

EXCESS OF ESTIMATES.

We believe that in all estimates of cost of any great enterprizes, whether by the United States; by a single state; by a city or individual; that the amount expended ninety-nine times in a hundred exceeds the original estimate. There are however some exceptions—that of the Charles river bridge, for instance, was estimated to cost 333 dollars a share, when it cost but 300 dollars; the city wharf, recently built, fell short of the estimate about 2000 dollars. And this would be of more frequent occurrence were

it not for the general failing which exists of endeavouring to keep an estimate down, many times, below what common prudence should dictate. Committees of estimates generally have those members upon them, who have an interest in the measure contemplated, and are apprehensive it may not be carried into effect, if they bring in too great a sum for its cost; and however incorrect it may be, every body knows it is often done, to get leave to begin the work and get so far in it as to secure its completion, and then come out and say the money is all gone, and the work perhaps but three quarters done. In one case it may occur to some that this has been the fact where the enterprize was not one quarter completed. A very great wrong is done by such proceedings. Publick bodies get to have but little confidence in estimates, and many times, some valuable improvements are prevented from being carried into effect, merely because a vote does not obtain for the measure, arising from the extreme aversion to experience the mortification of finding that a sum appropriated, and which perhaps was the outside of what was asked for, is reported by the dispensing committee as being short of what is actually necessary to complete the work.

BOSTON SCHOOLS.

The editor of the Christian Register in publishing the report on this subject, as contained in our first number, follows up the item of total expense of publick and private schools, in this city, with the following statement:—

"One hundred and ninety-seven thousand dollars are expended, annually, for the instruction of children and youth, in a city whose population little, if at all exceeds 60,000. We doubt whether the world can furnish a parallel example. And this expense, let it be remembered, is voluntarily incurred. No sovereign, no aristocracy, no foreign will commands this munificent encouragement of learning. It is the people's own act and choice. The calculations too, from which this result was deduced, were taken in a year of unusual depression, when both individuals and the guardians of the publick treasury were obliged to consider where retrenchment could best be made.

Besides this amount which is wholly expended for instruction within the city, many children are educated at academies or high schools in other places, where it is thought that advantages may be obtained for innocence and study which cannot be enjoyed in a large town. There are young men also, natives of this place, in the different colleges of New-England. At Cambridge there are, according to the last catalogue, among the undergraduates, 78 from Boston. The number at all the other colleges is not probably less, at an expense varying from $100 to $300 a year. The amount drawn from the city by both these classes cannot therefore be less than $40,000 and we presume exceeds $50,000; so that we should not probably go beyond the truth in asserting that the annual expenditure of the citizens of Boston for the education of the young is $250,000; and this too exclusively of lectures and other means of instruction which are open to youth, and of Sunday Schools which are established expressly for them.

COMMUNICATION.] [FOR THE MAGAZINE.]

Sir,—In your first number, I find an article on the "Use of Soap for Setting Cutting Instruments;" I have now to communicate to you another purpose to which soap may be applied, and with entire success, viz. the application of it to drills, when drilling iron, steel, brass, etc. Soap, or rather soap-suds, for this purpose, is far preferable to oil, as the drill cuts smoother, and with greater facility, and (as the article referred to above, observes,) "it is a more cleanly material," making it preferable, if on no other account but this; but its cleanliness is not the only recommendation it brings. It is well known that where oil is used, the detached particles of metal adhere to the main piece, by means of the oil acting as a kind of paste, and cannot be removed without a cloth, brush, or some other application; whereas, in the case of soap-suds, as soon as the drilled piece of metal becomes dry, the drillings may be removed merely by a slight blow upon the bench, or blown off by the mouth.

The manner in which I use it, is simply by making very strong suds, and applying it frequently to the drills while in operation.

E.

INVENTIONS.

The publisher of the Mechanicks Magazine is authorized by its conductors, hereby to give publick notice to all persons who may have any mechanical inventions, and who may wish to make a publick exhibition of them, that assistance will be rendered to them gratuitously in advancing their views; and that in certain in-

stances, suitable provision will be made, free of room rent, for such exhibition. Any information which will not interfere with the usual departments of professional advice, will also be given; and assistance rendered in making necessary application for patent rights; in making out and transmitting the necessary specifications, and in procuring engravings of the same. All communications, directed to the Magazine office, 52 Washington street, will receive due attention.

DRY ROT.

An article on this important subject is contained in the Journal of the Franklin Institute for December, taken from the Repertory of Patent Inventions, setting forth at considerable length the numerous causes which are supposed to exist for the dry rot in the timbers of ships &c. Upon this subject the Editor of the Journal remarks:

"The alarming prevalence of dry rot, especially in the timbers of ships, gives to every intelligent enquiry upon this subject, a very high degree of interest. At present we neither know the cause nor the cure of this premature decay in timber; opinions upon the subject being almost as numerous as the writers; and certain it is, that the preventives which have been proposed, were formerly unnecessary, in the same kinds of timber; and we confess that we are much more favourably disposed to the opinion that the place in which the fires were formerly made on board of vessels, had a favourable influence in preserving them, than that the disease has been produced by the substitution of foreign for the indigenous oak of Great Britain."

As ship building and the repairs of ships is a leading business in Massachusetts, we hope the attention of some of our ship carpenters, or owners of ships, may be turned to a consideration of this subject, and that we may have the pleasure of being the medium to the publick of the result of their views. This we should much prefer to the publication of the article referred to.

NORTHERN RAIL-ROAD.

The subjoined article is from the editorial department of the Windsor Republican. We select it from a number with which the papers in the interiour abound on the great subject of Rail-Roads, in regard to which, too much cannot be written, and we hope our friends will not be weary in well doing; that they will not be discouraged at the morbid state of feeling which seems at present to exist in this quarter—we allude particularly to the Massachusetts legislature; but by industry and perseverance and a good cause, it being none other as we believe, than that which pertains to the best interests of our common country, we cannot—yes, cannot but succeed.

"We ask the citizens of Massachusetts, New-Hampshire and Vermont, if the time has not now arrived, when we should be seeking in earnest for the best route for a *Rail-Road* from Boston through the interiour, which will enable that city to command and enjoy that portion of the country trade which nature has not denied to it? This object is one, the accomplishment of which is greatly to be desired, and which will be mutually beneficial to the city and the country. Boston has heretofore enjoyed a respectable portion of the trade of the interiour. Local facilities of communication, and the enterprize of the neighbouring States of New-York and Connecticut, and the inhabitants of a portion of Massachusetts herself, have drawn from her a large portion of this trade. And it cannot be disguised, that without some extraordinary exertion, the metropolis of Massachusetts must rank among the third rate commercial cities of the Union! The question is, how is this state of things to be avoided? We answer, by constructing a rail-way to the interiour. This is indeed a Herculean task—one which must employ much capital. And it is *all important*, that before any step be taken which cannot be retraced without loss and without chagrin, that it be well considered what portion of the interiour trade *can be* secured to Boston, and what will inevitably seek another port. The Hudson river, we believe is, and will continue to be the great highway of commerce for all places which can more conveniently seek its tide waters, than the tide waters communicating directly with any other mart than New-York. That city, then, is secure in the enjoyment of the trade of all such places. We believe it impolitick, therefore, ever to spend a dollar of capital, with a view of drawing the products of the interiour, once on the bosom of that river, across the country to Boston. The sooner, therefore, the idea of constructing a Rail-Road from Boston to the Hudson is abandoned, the better it will be for that city and all New-England. Instead of drawing the products of the west *to* Boston, it will tend to carry a portion of the trade east of the

Hudson *westward*, to some of the cities located upon that river.

But the question may then be asked, what then is left for Boston? We answer, the trade of the valley of lake Champlain, and of all the country west and north of that lake, which most easily centres upon its waters; a great portion of the Canada trade; the trade of Vermont; and that portion of the trade of New-Hampshire, Maine, Massachusetts and Rhode Island, to which she has heretofore been accustomed. But, to secure it, an effort must be made. And with a proper effort, *directed to the ultimate attainment of the object proposed*, we think it may be done. We cannot war against the gods; but in the attainment of those things which they have not forbidden, men are themselves as gods, when they put forth their energies, with the fortitude and perseverance of which they are capable.

It may be reasonably anticipated that lake Champlain will soon be connected with the St. Lawrence, at Montreal, by a ship canal. When this is done, Montreal, and a good portion of Lower and Upper Canada, will be brought within 160 miles of Boston, through the medium of that communication and the lake, while the southernmost point of the lake is 222 miles from the city of New-York. Here is a difference in *distance*, of about 62 miles in favour of Boston. Again, when a Rail-Road shall have been constructed from the lake to Boston, produce and merchandize can be conveyed from any point on the lake to Boston, with but one transhipment—that is, from the lake craft to the Rail-Road cars; whereas it requires two transhipments to get it to New-York—one from the lake craft to the boats plying on the northern canal, at Whitehall, and again from those boats to the vessels of the Hudson at Albany. This is an inconvenience which was not anticipated when the northern canal was constructed. But experience has shown that the same boat cannot be employed with safety and advantage on the lake, the canal, and the river. The hinderance and increased expense of frequent transhipments will at once be appreciated by all who are acquainted with business. And if a Rail-Road should hereafter be laid along the line of the northern canal, or *in its very bed*, (which it is not presumption to predict,) this inconvenience will not be avoided.

If the anticipations at present indulged in England, as to the rapidity and power of locomotive engines on Rail-Roads, are realized to half their extent, the difference *in time*, in favour of Boston over New-York, will be (including the transhipment at Albany) as four to one; and over Albany as two to one, while the northern canal is the medium of communication.

The Hudson is usually obstructed by ice over two months in the year, the canal between three and four months; and the St. Lawrence is unsafe for more than six. A Rail-Road is never obstructed by ice nor subject to *crevasses*, and if obstructed by snow at all, it will usually be but for a few days in the year.

Such a route, then, besides affording to Canada and the west a shorter and quicker passage to the sea-board, at all times when there is a choice of markets, will afford them the same facilities when all other communications are hermetically sealed. It will *pass through* as fertile, populous and interesting a section of the country, as any other route which can be laid from the city of Boston. This route, we think, must cross the high lands between Boston and the Connecticut river at Sunapee lake, in New-Hampshire, and the Green Mountain, in Shrewsbury, Vt. Or, proceeding from the Connecticut at Windsor, more northerly, pass the height in Vermont, through the Gulf, so called, and thence by the valley of Onion river to the lake. The former is 48 or 50 miles shorter than the latter, and is that which we apprehend will finally be adopted.

We conjure the capitalists of Boston, therefore, as they regard the permanent interests of that city, and we may add, of the country generally, that when they commence the construction of a *grand commercial highway* to the interiour, they will locate it in such direction that it may terminate by the shortest practicable route, on the waters of the lake, and thus effect this all important object."

TO READERS.

The similarity of views, between the writer of the article in our paper, on Publick Works, and Mr. Webster on the same subject, in his last speech, might lead to the charge of plagiarism, if the said article had not been in type before that speech was received. Our correspondent is, we believe, an anti-tariff man; it is consoling to see that honest and patriotick men can agree on great subjects of general good, although they may differ on points of minor importance.

We have several articles on hand for our next number, a considerable proportion of which are of a mechanical and scientifick character.

We feel flattered by the favourable publick notices which have been taken of the first number of the Magazine, both in the city and various parts of the country.